DANGERS OF ELECTRIC ARC LIGHTS AND STORAGE BATTERIES.

Conflagration and death are threatened by every inch of the big arc light wires, of which hundreds of thousands of feet are strung up all over the city. They are a constant menace to the lives of those who walk beneath them, and to the permanency of the stately buildings whose architectural beauties they veil and mar. They are liable to kill, with the lightning's suddenness and certainty, the fireman who directs a stream of water across them, and, now that means have been found for doubling the time of exposure to their mischievous power by the use of "storage batteries," their facilities for slaughter are to be extended to the household, the theatre, the workshop and the church. It is only a few days since that an electric arc light wire, dropping too near a lamp-post on Broadway, produced a result that the policeman on post described as "shoots of fire as long as me night club leppin out of it," and a number of cases have been reported by the police this season in which these wires have set fire to the foliage of trees in the public parks and squares. To this cause was attributed the burning of Martin Landenberger's mill in Philadelphia in September, 1881. In July, 1882, a fire was started in the show window of John Wanamaker's store, Thirteenth and Chestnut streets, Philadelphia, by an arc light wire, and in John Wyeth & Brother's drug store, No. 1412 Walnut street. Another conflagration was started by the burning of the supposably insulating covering on an electric wire. Possibly the most singular of all the many accidents reported as caused by the electric wire was that which occurred to a gentleman at the Paris Electrical Exhibition. He was leaning over a railing, and his dangling gold watch chain made a connection between two conducting wires, with the result of heating it red hot and setting fire to his clothing. So well has the danger of fire from these wires been recognized, that last year the Boston fire insurance companies made it the subject of an exhaustive investigation and adopted stringent regulations intended to control the employment of this mode of lighting so as to diminish its dangers.

But the hazard to life is even greater than that of fire, and the increasing number of fatal accidents caused by arc light wires, as their use is extended, demonstrates beyond question that public safety demands such measures of defense from them as have not yet been adopted. In February, 1882, Henry Balzer, a workman in Carnegie & Co.'s iron mill, Pittsburgh, was instantly killed by simply allowing a lamp that he held to touch an arc light wire. In the succeeding month two such accidents occurred—one in the Cleveland Rolling Mill, by which William Karampe, who incautiously touched a dynamo, was killed and had his arms and hands hideously charred and distorted; the other of a gas-fitter in Birmingham, England, who, toppling upon a ladder whereon he was standing, threw out his arm holding a pair of gas-pipe tongs to recover his balance, and, touching an arc light wire, fell a corpse at the foot of the ladder. In August last year to a soldier and a civilian, both young men, attending the Fête de la Jeunesse in the garden of the Tuileries in Paris occurred the bad idea of climbing over the wall in order to get out of the garden more quickly than by going to the gate. Arc light wires were strung along the top of the wall. The young men jumping up together caught the wires and fell dead at the foot of the wall. The incident is still fresh in the memory of New Yorkers in which a waiter, standing on the railing around the roof of the Metropolitan Concert Garden, clutched an arc light wire to save himself from falling and, instantly killed by the shock, plunged headlong, a corpse, to the street below. Also will be readily recalled the case of a workman of one of the arc light companies who, engaged in fixing the wires near Earle's Hotel, was killed by the current. Even when accidents caused by contact with these electric wires have not fatal results they often have very serious consequences. During the Paris Electrical Exhibition a gentleman was almost killed by stepping inadvertently upon a conducting wire and at the same time touching a lamp that formed part of the conducting system. In Brighton, England, the whole company manning a fire-escape machine were stunned and one of them barely escaped with his life in consequence of the escape upon which they were mounted coming in contact with an arc light wire that crossed the street.

A little investigation of the subject will convince any disinterested person that the placing under ground of the arc light wires is a measure imperatively demanded by considerations of the public safety.

An expert, of world-wide reputation among electricians, one who has given much experimental study to the electric arc light, in the hope of overcoming the various great objections to which it is open, remarked the other day in presence of a reporter that he had entirely abandoned it as quite a hopeless subject.

"Is it true, as alleged," he was asked, "that there is great danger to life and property from its use?"

"Most unquestionably true, and always will be so," he replied.

"Will not the same objection apply to the use of the incandescent light?"

"By no means. Let me explain. In the first place, there is no essential difference in the danger derivable from the use of the electric lamp *per se*, whether an arc or an incandescent light, but, unfortunately, it is a necessity in the use of the arc lights that they shall be connected in what is known as a 'series' method. That is, the current from the dynamo must pass through each lamp consecutively, so that whatever pressure is required by a single lamp must practically be multiplied by the number of lamps in the circuit. To illustrate: suppose an arc light requires a pressure of 30 volts, [the volt being the unit of electric pressure measurement], two would require 60 volts, 10, 300; 20, 600, and 40—which is, I believe, the highest the Brush Company uses on a circuit—would necessitate a pressure of 1,200 volts. Thus, by this method as lamps are added, the pressure must be increased. Incandescent lamps are connected in a different manner, by what is known as the parallel or multiple arc method. In that the pressure required on a single lamp is the same as that required for any number. Say, for instance, that the pressure required for an individual lamp is 110 volts; no matter how great the added number of lamps may be, even up to 1,000,000, the pressure of the current in the conducting wires, whether in the streets or in the houses, is that of the single lamp's requirement—110 volts, and no more.

"But, in saying that a pressure of 1,200 volts is needed for 40 arc lights, we by no means give the full quantity of pressure demanded. That is what the lights themselves must have. In the distribution of electricity to supply a considerable number of lamps a certain loss in the conductors is inevitable. The greater the distance the lamps are from the source of supply the greater will be this loss, and, as the temptation is to supply, as far as possible, from a central station, the pressure frequently used in the arc light conducting wires to feed the lamps and make up for that loss reaches from 2,000 to 2,400 volts.

"The Parliamentary Committee appointed by the House of Commons in 1881 to pass upon or investigate numerous questions connected with the electric light had before them the question of the amount of pressure which it was perfectly safe to introduce into residences, stores, theatres, etc. Different witnesses gave what, in their opinion, was a safe limit of current pressure, agreeing that anything under 200 volts was perfectly safe, and any above 300 volts was decidedly dangerous. Sir William Thompson said that it should not exceed 250 volts. The English law now restricts public lighting companies to a pressure of 300 volts. Even the highest pressure that those experts allowed as safe, you will observe, was but one-eighth of what is frequently employed in the arc light conductors. In the accident at Hatfield House—the Marquis of Salisbury's—by which the gardener, William Dimmock, was instantly killed, the current was brought from a distance of some two miles to supply 117 arc lights in the house and grounds, and the pressure used was 2,400 volts. In the very recent accident at Dayton, Ohio, when Superintendent Robbins, of the Fuller Company, an expert, was killed, the pressure in the conductors was not stated, but was probably far below that commonly used in feeding circuits of arc lights, yet was sufficent to kill the man instantly, and he only touched one wire, there being an accidental ground somewhere on the circuit.

"The object in having electricity at high pressure is to overcome the resistance of inferior conductors. The human body is an inferior conductor, offering in different individuals a resistance of from 11,000 to 17,000 ohms. The low-pressure electricity used in the supply of incandescent lamps viz., 110 volts, is sufficient to overcome this great resistance, but the high pressure used for the arc light is more than sufficient, and if it is accidentally diverted from its copper conductors through a living body, whether man or beast, will instantly destroy life."

"Under what circumstances is this danger liable to occur?"

"In various ways. It is liable to occur to the men employed in and about the stations where the machinery is located; to the men who replace the carbons in the lamps; to telegraph and telephone linemen who have repairs to make on lines of wire among which, or crossing which, the electric arc light wires are suspended; to citizens who venture upon their own house-tops where those deadly wires may be; to policemen who pursue fleeing thieves on the roofs, as they frequently have to; to firemen who have to clear away the wires to get at a burning building, or are liable when half blinded by smoke and fire to inadvertently touch one of these mechanical assassins; to employés in buildings where these lights are used, and to visitors in such buildings, even though they may not actually touch the wires. For instance of the latter, a case was reported not long ago in which one of the arc light wires came in contact with an iron column against which a customer was leaning in a bar-room. The customer was knocked down senseless, but fortunately did not receive a fatal shock, probably because the incident occurred near the extremity of supply on the circuit.

"As for the dangers to which firemen are exposed by the arc light wires, they are so great that, were they generally known, I have no doubt the knowledge would materially affect our fire service, possibly excite such feeling as to inforce suppression of this most perilous system, or at least the burying of its murderous conductors deep under ground. Not only by actual contact with the wire itself is the fireman likely to be killed instantly, but in either of two other ways. Suppose that a hose is attached to one of the metal pipes—'stand-pipes,' I believe they are called—with which our large modern buildings are now supplied for throwing volumes of water through branches into any story where it may be required, and that one of the arc light wires comes in contact with that metal pipe. The tendency of the current being always to return to the dynamo by the shortest path, it naturally seeks the earth, but, since this pipe terminates upon the wall of the building a few feet from the earth, the current will pass from the pipe through the stream of water—water being, as you doubtless know, a good conductor—and through any other conductor which may intervene between that stream of water and the earth. If that stream, so charged, should be applied directly upon an individual who happened to be standing upon the ground—wet ground particularly—the current would pass through his body, and in all probability kill him instantly. It only requires for that, that the pressure of the current should be sufficient to overcome the natural resistance of the water of the human body interposed in its path. The other danger threatening the fireman, apart from his personal contact with the wire, is through the streams of water from a nozzle held by him, which, if it comes in contact with an arc light wire in which the electricity is at high pressure, is liable to instantly offer a new path for the subtle and deadly fluid. Suppose the man standing on wet ground, grasping with wet hands a metal nozzle, making in this way a connection with an arc light wire somewhere near the dynamo, where the pressure is greatest, the insulation on the wire would be instantly destroyed—for the force of the current is sufficient to pierce a plate of glass half an inch thick—and the death-dealing spark would reach the man and kill him infinitely quicker than thought.

Most firemen know by this time the extreme unhealthfulness of trying to chop off an arc light wire that may chance to be in their way, or of trying to push it aside, and they are not uninformed of the power demonstrated by these high-pressure wires in the transmission of dangerous currents through the fire-alarm wires by chance contacts; but it may be a new view to most of them that they are liable to meet death from this fruitful source of terrors when well removed from personal contact with the wires, and simply by means of a connection through a stream of water. Last winter the electro-magnets in a dozen down-town fire-alarm boxes were burned out by an arc light wire touching a fire telegraph wire, a fact which interested not only firemen, but all citizens, since it revealed a great peril—the cutting off of fire alarm—that is likely to occur from this cause at any moment. About the same time the assistant foreman of a fire company, when he went to take a key from a fire-alarm box, received a very violent shock, almost fatal, from the current diverted from an arc-light wire by a fire telegraph wire and so carried to the box. During the past month a fireman at a fire on Water street was almost killed by a shock from an arc light wire that had to be cut to enable the firemen to get at a burning building and put out the fire. I could cite scores of such instances, but it is not necessary. The facts are beyond question."

"You said something about danger from these wires to persons in buildings where they are introduced for lighting purposes. May that not be overcome, there at least, by proper insulation?"

"All materials are conductors, in some degree, even glass, and what is called insulation is only covering a good conductor with a very poor one; but to overcome the resistance of any poor conductor, or, in other words, destroy the insulation, it is only necessary to make the pressure of electricity sufficiently great. That is why there is no danger of fire from such low pressure currents as are used in the incandescent system of lighting, because they are not sufficient to overcome the resistance of the insulating poor conductor, while the danger from the enormous pressure required for a full circuit of arc lights is very great, because it is almost impossible to employ anything for insulation that a current of such intensity will not pierce when a shorter path for return to the earth is offered by any moderately good conductor to the current. Where buildings are constructed of metal,

or have gas or other piping of metal running through their structures, it is only necessary that the electric arc light wires should come in contact with that piping to convey the current to the earth, and therefore it may readily happen that by simply touching a water or gas pipe a person may receive the same shock as if he had touched the wire directly."

"Will any of the objections to the use of the arc light be removed by the employment of the new device of storage batteries?"

"No. On the contrary, they will be increased. It is proposed to charge these batteries during the day, by currents which at night are switched off from them and used to supply arc lights. So far as the general public and the firemen are concerned, that simply increases by so many hours the time of exposure daily to the dangers inseparable from the presence and operation of these wires. Before the storage battery was got up it was only after dusk and up to 1 or 2 o'clock in the morning, as a rule, that these copper nets were spread abroad to kill. The charging of those batteries is as full of danger as is the ordinary use of the arc light. At the same time, while charged and not in operation, they are far more hazardous than powder or dynamite magazines, so far as human life is concerned. They must be charged up to the highest possible pressure. While that pressure is confined in them the lightest touch by the finger of an innocent child, or an incautious servant, or an ignorant stranger, is punished by certain and instant death. The best hope that the public has in this matter is in the fact that the secondary, or storage battery, is commercially impracticable, that it cannot be operated with less than 30 per cent. annual deterioration in itself, that it consumes a quantity of electricity vastly disproportionate to the results obtained from it, and that after it has served its day in gulling, more or less, thousands of Simple Simon stockholders, it will exist no more except as a scientific curiosity to some and an exasperating memory to others. Let us hope that it may not kill a great many people before that time arrives."—*N. Y. Times.*

WATER-POWER OF THE SOUTHERN ATLANTIC SLOPE. *

BY MR. GEORGE F. SWAIN.

The 282nd meeting of the Society of Arts was held on Thursday, March 23, at 7:30 p. m., President Francis A. Walker in the chair. After the transaction of some matters of business, the President introduced Mr. George F. Swain, of the Institute, who spoke of The Water-power of the Southern Atlantic Slope of the United States.

Mr. Swain gave a brief description of the general structure of the Appalachian Mountain system, and a comparison between the character of the streams in the northern and southern portions. His remarks had reference only to that part south of the James River. The total area of the region studied was about 117,350 square miles, with an average width of about 240 miles. The rivers are navigable from the ocean in many cases nearly up to the point where falls are found, but are obstructed by sandbars and snags to a considerable extent. Upon the maps exhibited a line was drawn through the lowest points at which falls occurred on the streams. Between this "fall line" and the sea there is no water power, and the streams are sluggish. From this line to the sources of the streams are located all the powers.

In the discussion of the amount and value of the various powers it is necessary to know something of the amount of water flowing in the stream. As few measurements of this sort have been made on these southern rivers, considerations as to the amount of rainfall and the nature of the soil must be used in making these estimates. Charts showing the amount of rainfall in various parts of the region were shown. The rainfall is often greater in this region in winter than in summer, but at that time the evaporation is less rapid, and hence the streams would receive the greatest addition when least needed, and would thus be more variable than the rivers of the northern region. The absence of lakes and the rapid removal of forests also contribute to render these streams more irregular in flow. As there are no considerable falls of snow, and no great formations of ice, the southern streams would be comparatively free from spring freshets.

The facilities for artificial storage basins in this region are not particularly great, as in many cases the valleys which must be overflowed compose the best farming lands.

The convenience of transportation is an important consideration in the estimate of the value of a power, and the location of the railroads at present is somewhat unfavorable. The topography of the region is such as to render it easier to secure a good location for the railroads upon the divides or ridges separating the streams than along the valleys. Hence many of the falls are at a distance from the roads.

The following brief list of some of the most notable powers, most of them undeveloped, will show, however, that there is a very large amount of available power upon these streams. The figures are given only for the most important powers, and are computed from approximate figures for the dryest season of a year dryer than the average.

The Roanoke River has at one place a fall of about 84 feet in nine miles, which could furnish about 18,500 horse-power.

The Dan River, at Danville, Va., has a fall of 22 feet, capable of furnishing 1,200 horse-power.

The Tar, at Rocky Mount, has a fall of 20 feet, with 350 horse-power.

The Cape Fear has, at Smiley's Falls, 27 feet fall in 3¼ miles, with 2,850 horse-power; and at Buckhorn Falls 20 feet fall, with 2,000 horse-power.

The Deep and Haw rivers are the most utilized of the streams of North Carolina. The former has eight cotton factories, and has a fall of 24 feet at Lockville, giving 800 horse-power, which is partially utilized. The Haw carries seven cotton factories. Both have several powers not utilized.

A very remarkable gorge exists at the Narrows of the Yadkin River, where there is a fall of 150 feet in 3⅛ miles, which could furnish 15,000 horse-power, but owing to the precipitous nature of the banks cannot be made available. At Bean's Shoal is a fall of 39 feet in four miles.

Upon the tributaries of the Santee are several fine powers. Of these the Wateree has falls of 42 feet, 173 feet, 35 feet and 25 feet; the Congaree, at Columbia, S. C., one of 22 feet; the Broad and Lockhart shoals one of 46 feet in 1½ miles, and at another point one of 102 feet in 6½ miles; the latter is, however, inclosed by rather steep banks. Upon the tributaries of the Board are many more smaller powers.

At Augusta, Ga., is one of the best powers in the South. The Savannah River there has a fall of 50 feet from the Augusta Canal, seven miles long. Of this fall 33 feet are utilized, capable of furnishing 9,000 horse-power, of which but a portion is now used. At Trotter's Shoals is a fall of 75 feet in seven miles, and in the upper tributaries are many smaller falls.

The Altamaha River has on its tributaries many powers, but little used.

* Proceedings of the Society of Arts.

DESIGNS AND SPECIFICATIONS.

The subject of designs and specifications, which has so recently occupied the attention of the Society of Engineers, has been also discussed in Germany. In that country, however, the subject has been taken up by an amalgamated society of architects and engineers. A congress of members from the various architectural and engineering societies in the German Empire was held last month, at which 19 of such societies were represented. The principal subject of discussion at this congress was a system of regulations drafted by the Hamburg society, the object of which was to procure the adoption of a uniform method of procedure in contract work. It will be seen that the regulations relate more perhaps to the architect's responsibilities so far as his employer is concerned, than to the relative positions and responsibilities of architect (or engineer) and contractor. This is only what might be expected of regulations drawn up by one side only; and, moreover, contract work abroad is not conducted on quite the same system as in this country. Most contractors will, however, agree with Clause 1, which relates to drawings. How often has the contractor to lament that want of "clearness and comprehensiveness of detail" which is insisted on in this clause. We fear that he will perforce continue to lament, until contractors have their own society and make a hearing for themselves.

Below will be found the regulations drawn up by the congress of German architects and engineers:

I. *Drawings.*—Drawings must be executed with a clearness and comprehensiveness of detail appropriate to the purpose in view, and they must be such that the design can be carried out from them in accordance with the generally acknowledged rules of architecture, the prescriptions of the law, and the use to which the structure is intended to be put. A part from those drawings which represent an object (structure) in its actual dimensions, the professional man (architect or engineer) is responsible only for the measurements he assigns in writing, and not for those deduced. The fact is, sketches or experimental attempts at the solution of a technical problem are imperfect and does not establish any responsibility on the part of the professional man.

2. *Estimates of Cost and Value.*—In general estimates of cost and prices, the professional man, in the absence of an agreement to the contrary, is not responsible for any mistakes or errors that may be made in calculation. In the case of detailed estimates of cost, the professional man is responsible for the correctness of the measurements or computed quantities, and likewise in case he fails to include any objects required for the proper execution of the design. But his responsibility in these matters is limited to his making good the additional expense to which his employer is put by having to pay for the materials or objects omitted more than he would have had to pay if they had not been overlooked; or, in the opposite case, by having to sell again at a loss to material or objects he ought not to have been called on to procure. For the scales of prices charged, and the calculations based thereon, the professional man is not responsible.

3. *Terms and Conditions of Building Contracts.*—The professional man is responsible for any loss his employer may be put to by any violations of the generally acknowledged rules of architecture which may be found in the terms and conditions of building contracts drawn up by him. For losses inflicted on the employer through omissions, or through the neglect of legal prescriptions in the conditions of building, and the contracts drawn up by the professional man, the latter is so far responsible that he must make good the extra expense the employer is put to through having to pay for materials or objects a higher price than he would if such mistakes had not been made.

4. *Opinions and Reports.*—In the absence of an agreement to the contrary, the professional man is not responsible for losses arising from oversights in the preparation of opinions or reports.

5. *Direction of Building Operations:* (*a.*) *In General.*—Without the general or special authorization of the employer, the professional man charged with the direction of the building operations is not justified in ordering any departure from the particulars as to the manner of carrying out the work prescribed in the drawings or in the contract. A general authorization given to the professional man by the proprietor does not, in any cases of doubt, include the authorization to order any deviations such as will entail extra expense. During his hours of business the professional man is bound, either in person or through his assistants, to give in his office such information as may be desired by the proprietor, or by those employed in erecting the building, respecting the details of the construction.

(*b.*) *Explanations of Designs.*—The professional man charged with this department has to explain the drawings and terms of the contract to those whose duty it is to carry out the practical operations.

(*c.*) *General Supervision.*—The professional man charged with the general superintendence has periodically to visit the scene of operations, or place of work, at intervals left to his own judgment, or to cause such visits to be made by his assistants; he has to give appropriate directions for carrying on the operations, and, during the visits of himself or his assistants he has to make experiments with a view to test the materials, and the quality of the work done; he has also to give directions so as to remedy any mistakes which those experiments may bring to light. His responsibility in reference to faults in materials or work is limited to those discovered by the tests or examinations made by himself or his assistants, and which he has neglected to take measures to remedy.

(*d.*) *Special Supervision.*—The professional man charged with the special superintendence has to examine the materials and work, with a view to ascertain their suitability and their conformity to the terms of the contract, and he is so far (but no further) responsible for every mistake that he has to replace at his own cost that which is defective by what is satisfactory. In the absence of an explicit agreement to undertake the duties of special supervision, the task of the professional man who is charged with the superintendence is simply that of general supervision.

6. *Purchase of Buildings, etc.*:—(*a.*) *General.*—The professional man employed on the general examination of a building has to test by experiment the visible parts of the building, or other object surveyed, with a view to ascertain if there are any defects. For such deficiencies as he does not inform his employer of, though he may have noticed them, he is responsible, with this proviso—that he will have to refund the extra expense to which his employer is put on the subsequent discovery of the defects, in consequence of the rise of price in materials or labor, as compared with what his outlay would have been if he had received information in time.

(*b.*) *Special.*—The professional man charged with the special examination has to examine in detail all parts visible, and not visible, of the building or object surveyed, with a view to detect any defects that may be present. Such defects as he fails to bring to the knowledge of his employer he must remedy at his own cost; his responsibility, however, is limited to repairing the building or material surveyed. In the absence of an express agreement as to the special duties, the professional person's responsibility is limited to the general duties.

7. *Revision of Accounts.*—The professional man charged with the revision of accounts is responsible for the loss his employer suffers when errors of calculation in the accounts are not pointed out. The revision of accounts likewise includes that of the prices given in such accounts, so far as regards their conformity to the contract, or their fairness in cases where there is no contract. The examina-

tion of the quality of the articles mentioned in the accounts is not included under the revision of the accounts, and only in case of special agreement is the correctness in point of number or quality of the articles mentioned in an account to be included in the revision. A professional man is responsible for oversight in such revisions only in case of the insolvency of the party sending in the account.

8. *Duration of Responsibility.*—The responsibility of the professional man terminates a year after the handing over of the building or other object. In cases of the revision of accounts, as well as such work as does not refer to a building designed or erected by him, the professional man ceases to be responsible twelve months after the performance of his task.

9. *Final Article.*—All rules contained in these special sections are subject to the provisions of the general regulations.

GENERAL REGULATIONS.

1. Losses arising from delay in executing work that has been undertaken are not made good, except there is an agreement to that effect.

2. The professional man is not responsible for any loss occasioned to his employer by a violation of æsthetical laws.

3. Losses arising to an employer through the non-attainment of some object he had in view, but of which he failed to inform the professional man when concluding the agreement, are not recoverable.

4. If buildings or other objects are defectively executed, owing to some circumstance for which the professional man is responsible, then the latter is held responsible for making good the damage upon the building or other objects itself.

5. Losses are not made good which arise from the non-observance of laws or regulations that are not in force in the professional man's district, and which the employer failed to bring to his notice.

6. For losses caused by a professional man's assistants in the execution of their professional functions, he is responsible just as though he had caused them himself.

7. A professional man who has not the responsible direction of the operations on a building is not responsible for damage occasioned by defective performances of his own, if the latter could have been avoided by placing the management in his hands.

8. Losses arising from defective execution fall upon the professional man only in case of the insolvency of the actual builder.

9. When a proprietor employs laborers or tradesmen to carry out the designs of a professional man, then, if the latter has not approved of them, and there is damage done, the onus of proving that competent laborers or tradesmen have been employed will fall upon the shoulders of the proprietor.—*Contract Journal.*

THE UNITED STATES CENTRAL RAILROAD.

There is at last some prospect that we are to have a new overland line which will be an important competitor of the various lines either owned or controlled by the Central Pacific, and will furnish San Francisco the relief of which it has so long stood in need. This, it is hoped, will come through an organization called the United States Central Railway Company, which will build a road from San Francisco to Denver, Col., having a main line 1,200 miles in length and 300 miles of branches. The new company is formed by the uniting of the Ocean Shore and California Central Companies, organized in Nevada, Utah and California about three years ago. The San Francisco terminus will be at North Beach. Thence the route extends by way of the park to the ocean shore, which it follows to Santa Cruz. From Santa Cruz it runs eastward, crossing the coast range south of Gilroy, whence, passing across the San Joaquin Valley, it intersects the Southern Pacific near Madera station. Then it ascends the western slope of the Sierras, crossing the summit not far from the Mariposa Big Trees. Thence descending the eastern slope of the Sierras by an easy grade, it passes through Southern Nevada and Southern Utah to its destination. At Denver it will connect with the system of the Chicago and Burlington Railroad and other lines radiating from that point. From Southern Nevada a branch will be extended southeast to meet the Atlantic and Pacific at or near the Colorado River. The surveys were made two years ago. The grades are nowhere especially difficult, and most of the country through which the proposed line passes is highly productive. The coast between here and Santa Cruz abounds in timber, has fine agricultural resources, and as it has a mild climate and much beautiful scenery, the road will make accessible a number of pleasant seaside resorts. The west side of the San Joaquin Valley is rich and has at present no railroad advantages. In crossing the Sierra the route is through one of the finest timber regions on the Pacific coast, and in Nevada it is expected that it will give an impulse to mining in regions hitherto neglected on account of inaccessibility. Southern Utah is an undeveloped region, abounding in coal, iron, lead, copper and other valuable minerals. The new line will depend in a great measure on the local trade which it will develop, though from passing near Yosemite, having the advantage of being central and direct and passing through some of the finest scenery in the world, it will expect to command its share of overland trade and travel.

ELECTION OF OFFICERS.

The company incorporated in Colorado a few days ago and yesterday its incorporating stockholders met at the office, at the corner of Kearny and Market streets, and elected the following officers:

President—W. W. Walker, Cedar Rapids, Ia.

Vice-Presidents—John Sharp, Salt Lake City, U. T.; E. T. Wells, Denver, Col.; Sampson Tams, San Francisco, Cal.

Secretary—Charles E. Walker, San Francisco, Cal.

Treasurer—R. H. McDonald, Jr., San Francisco, Cal.

Auditor F. Madge, San Francisco, Cal.

Chief Engineer—Lyman Bridges, San Francisco, Cal.

Counsel and Right-of-Way Agent—W. L. French, San Francisco, Cal.

Attorneys—R. H. Lloyd, San Francisco, Cal.; E. T. Wells, Denver, Col.

Directors—William W. Walker, John Sharp, A. D. Sharon, Lyman Bridges, E. T. Wells, Charles Kohler, R. H. Lloyd, J. H. Kinkead, M. Skelly, William L. French, Robert Turner, D. L. Randolph, Sampson Tams.

THE SUBSCRIBERS.

The subscribers number about 150 persons, living in San Francisco, Salt Lake, Denver, Chicago, New York, Philadelphia, London and other places. The following is a partial list:

William W. Walker, Charles Kohler, Richard King, John Sharp, H. D. Cogswell, R. H. Lloyd, D. E. Garrison, Columbus Bartlett, E. T. Wells, A. H. Washburn, William S. Opdyke, R. H. McDonald, Jr., A. L. Bancroft & Co., A. P. K. Safford, W. S. Gage, William L. French, M. M. Delano, R. H. Magill, J. Collett, Samuel McCullough, P. W. Johnson, J. A. Blossom, John F. Kennedy, Isaac Cooper, A. D. Sharon, J. H. McChesney, James D. Thompson, Milton Weston, J. P. Manrow, John L. Beveridge, Robert Turner, C. C. Webb, Lansing Millis, Lyman Bridges, Charles W. Matthews, E. W. Chapman, John C. Short, M. Skelly, Charles W. Lewis, Robert N. Graves, William C. Miller, W. W. Alexander, F. Little, H. W. Quitzow, L. F. Loveland, Z. P. Denler, F. Dirking, George F. Cochnower, A. S. Hubbard, E. L. Smith, James McKinley (trustee), Edward S. Salomon, J. S. Shearman, C. D. Cleveland, William E. Burroughs, Charles R. Thompson, R. H. Parks, B. B. Minor, John Duff, W. S. Godbe, Jas. Turner, Saml. Miller, Francis Cutting, R. P. Mace, William McCandlish, E. E. Haft, H. S. Eldredge, A. Bateman, Charles L. Easton, William Andrews, Jr., Vandewater Smith, J. C. Currie, William S. McCormick, Samuel Grove, William G. Le Duc, D. L. Randolph, M. San Pedro, S. R. Krom, Sampson Tams, John H. Kinkead, F. W. French, William Jennings, Francis Bridges, Warren T. Hecox, S. M. Holmes, J. T. Little, F. C. Lord, E. D. Wheeler, James S. Story, George D. Nagle, William P. Watson, J. H. Mathewson, P. E. Connor, Alvah Mansur, John W. Smith, Joseph S. Fullerton, H. H. Pearson, James P. Pierce, E. Rundell, C. W. Swanton, C. E. Driscoll, A. R. Atkins, M. G. King, Henry E. Peyton, R. P. Saxe, James J. McCarthy, C. W. Brush, O. H. Violet, G. W. Davenport, F. W. Bowen, J. H. Bates, Isaac Bluxome, W. J. Shaw, R. Rickard, Joseph Hyman, L. Orrin Sharp, M. M. Baldwin, John Haley, Edmund Wilkes, George A. Koch, J. L. Cogswell, T. H. Humphreys, Otis V. Sawyer, R. P. Layton, C. W. Patten, P. H. Blake, T. Kempert, George T. Knox, Charles E. Anderson, F. Madge, A. P. Dennison, Edwin Moore, James S. Reynolds, William G. Miller, H. C. Patridge.

The list represents over $50,000,000, a large portion of which is in San Francisco, as will be seen by examining the names of our rich men included in it. Mr. Walker, the president, is the President of the St. Louis, Hannibal and Keokuk Railroad, and has had much experience in railroad building and management. Richard King is President of the National Bank of Commerce of New York. Bishop Sharp is a wealthy Utah capitalist and President of the Utah Central. John L. Beveridge has been Governor of Illinois and member of Congress. D. E. Garrison is a rich railroad capitalist of St. Louis. William S. Opdyke is a New York capitalist. J. Collett has been President of the Terre Haute and St. Louis Railroad and of the Nevada Central. William McCandlish is a railroad engineer and representative of English capital. Vandewater Smith is ex-President of the Long Island Railroad. Charles L. Easton is of the Chicago Bench. William S. McCormick is a Salt Lake banker. William Jennings is Mayor of Salt Lake City and President of the Deseret National Bank. John C. Short is President of the American Finance Company of New York. R. H. Parks is a New York banker. Warren T. Hecox is a Chicago capitalist. Among others of importance are Judge Wells of Denver, ex-Governor Kinkead of Nevada, Alvah Mansur, a wealthy merchant, and Lansing Millis, a wealthy railroad capitalist of Boston.

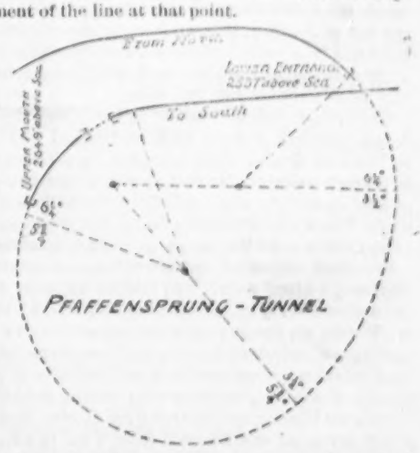
TO BEGIN AT ONCE.

The new company has wealth and respectability behind it and is evidently much in earnest in its plans. It is intimated that as soon as the bonds are ready all the capital needed will be forthcoming. Work is to be begun at both ends of the road and on the Yosemite division, using the intersection with the Southern Pacific as a point of departure. No trouble is expected in obtaining all the labor needed, contractors being already in the field with offers to furnish any number of men. The completion of the Northern Pacific has liberated some thousands of laborers, and work having ceased on the Canadian Pacific for the winter, many thrown out of employment will come this way if they think they are likely to be wanted during the winter or spring. The property at North Beach originally intended for the depot of the company is still available, having been kept in bond for two years pending the arrangements now made, which appear to be final. The new company has selected an appropriate name for their new line. Their plans are feasible, and the project, as far as the public can judge from the facts given herewith, is certainly hopeful. The immediate commencement of operations is promised, and we are told that the entire line will be completed in three or five years. Quick work will be needed to fulfill these pledges.—*San Francisco Chronicle, Oct. 31.*

THE CIRCULAR AND OTHER TUNNELS OF THE ST. GOTHARD RAILROAD IN SWITZERLAND.

[Compiled by Geo. J. Specht, C. E. for ENGINEERING NEWS.]

The most interesting tunnels upon this railroad are the circular ones, of which there are three on the north side and four on the south side of the Gothard tunnel. The lowest on the north side is the Pfaffensprung tunnel, which was necessary to overcome a sudden ascent in the valley of the Reuss. Sketch No. 1 shows the whole development of the line at that point.



The spiral is formed by a compound curve of four different degrees, namely: first, 6¼°, then 3½°, then 5¼°, and finally again 6¼°, and by the adjoining tangent. The length along the line from the tunnel entrance to the point where the upper line intersects the lower one, is 6,986 ft., by which development an elevation of 167.5 ft. is gained, the grade being 137.3 ft. per mile on the open line, and 121.5 ft. per mile in the tunnel. The spiral tunnel itself is 4,845 ft. long. The geological features of it are as follows, beginning from the lower entrance:

A, 1,469 ft., exceedingly hard and compact granite and eurite, very difficult to blast.

B, 1,605 ft., hard granite gneiss, occasionally stratified.

C, 252 ft. micaceous schist in this strata, with beds of quartz.

D, 1,420 ft., same as B.

E, 99 ft., same as A.

The flow of water from the lower entrance was 1.25 gals., while the influx at the upper section was 0.44 gal. per second.

The tunnel was worked from both ends with a top-heading, and later with a bottom-heading. The lower heading was worked by machine drills, while the upper one was driven by hand. The machines employed were at first the so-called

Frohlich drill, a percussion drill of European construction. The air-compressors—two in number—were worked by a turbine, which required 527 gals. per second under a head of 31 ft. To obtain this power, a dam of solid masonry, 66 ft. long, 23 ft. high and 10 ft. thick, across the river Reuss, and a ditch of 854 ft. length and with a cross section of 21.5 sq. ft., were required. Four drills and three columns were kept on hand. The wrought-iron air-pipe had a diameter of 4 in., the single length being joined by flanges. The drills are supported by a column pressed by hydraulic pressure against the sides of the tunnel. There drills, each supported by a separate column, were worked in the face of the heading, which, up to the end of November, 1879, had a cross-section of 86.29 ft., and thereafter varied from 59 to 65 sq. ft.

Each machine was worked by two men. The drill-holes had an initial diameter of 2 in. and a final diameter of 1⅛ in., and a depth of from 2.3 ft. to 2.6 ft. Ten to seventeen holes were required for one attack, which took from 3½ to 6½ hours for drilling and from 4½ to 6 hours for blasting and removing the débris. The pressure in the compressors was equal to 53 lbs. per sq. in. Each attack advanced the face from 1 ft. to 2.3 ft. according to the nature of the ground. One foot of drift required from 10 to 17 lbs. of dynamite No. 1, and from 30 to 88 drills. The repairs on the machines were very numerous, and one or two of them were constantly in the shop.

Toward the end of 1879 it became apparent that the tunnel would not be finished in contract time at that rate of progress(only 364ft. in 105 days),and the contractor decided to employ the then favorably introduced hydraulic rock drills, system Brandt; and also to abandon the top heading and make the bottom heading the advance drift. At the end of January, 1880, all the necessary preparations had been made,and the work with the Brandt drills commenced. On March 15, 1880, the percussion drills were entirely laid aside.

The Brandt drill is worked by very high hydraulic pressure, and has a hollow drill-rod which rotates very slowly. It is supported by a column 8 ft. long, resting on a small carriage, and being pressed against the sides of drift by hydraulic pressure. The working pressure on the drill-bit varied from 1,050 to 1,450 lbs. per sq. in. Each machine —two being supported by one column—required two men, 8 hours' shift. The interior diameter of the drill-rod is 1⅝ in., and the exterior one 2 7-16 in. The bit has 4 teeth protruding beyond the sides, making a bore-hole of from 2¾ to 2⅞ in. diameter. Each attack required from 6 to 10 drill-holes of a depth from 3 to 5 ft., 3 to 8 hours for drilling and 3 to 6 hours for blasting and removing the débris. Each attack advanced the heading from 2 ft. to 4 ft., according to the rock. One foot of drift required from 6 to 14.5 lbs. of Nobel's explosive gelatine, and the sharpening of from 5 to 18 drill-bits. Hardly any repairs on the machines were necessary.

The connection between the two headings was made at a distance of 3,258 ft. from the lower entrance, and a survey showed a deviation of 0.40 ft. in alignment, 0.44 ft. in length and 0.66 ft. in elevation. The total excavation of this tunnel amounted to 92,000 cu. yds.

TABLE 1.

Showing daily progress of advance-drifts in the Pfaffensprung Tunnel.

	Percussion drills.	Hydraulic drill.
Smallest daily progress	3.28′, Dec., 1879	4.92′, July, 1880.
Largest " "	4.27′, Jan., 1880	8.53′, Dec., 1880 / Jan., 1881
Average " "	3.87′	6.75′

	Hand drilling.	
	Lower header.	Upper header.
Smallest daily progress	1.31′, July, 1879	1.31′, July, 1879
Largest " "	2.61′, Dec., 1878 / Apr., 1879	2.05′, Feb., 1879 / Apr., 1879
Average " "	2.00′	2.18′

While the percussion drills were used the ventilation was procured by the escape of the compressed air, but when the Brandt drills were used, a fan, situated at the mouth of the tunnel, was employed. The air-pipes were of galvanized iron and had a diameter of 9 in. Immediately previous to the connection of the two headings the temperature in the face was 66° F., the outside temperature being 52° F.

The development of the line near the village of Wasen includes two circular tunnels, the one being called the Wattinger, the other the Leggistein tunnel.

The Wattinger Tunnel lies on the right hand bank of the river Reuss, and forms the connecting link between the lower and middle line—there being three lines, one above the other, on the same side of the river. The lower entrance is at an elevation of 2,935 ft. above the sea and 41 ft. above the river, while the upper mouth is 3,001 ft. above sea level, and 46 ft. above the river. Immediately adjoining both the entrances the river is crossed on iron bridges of 131 ft. and 147 ft. span. The circular tunnel is 3,557 ft. long, of which 321 ft. are on a tangent and 3,236 ft. on a curve of 5¾°. The grade in the tunnel is 116 ft. per mile. The rock consists mostly of hard granite gneiss in vertical strata, with frequent layers of micaceous schist. Only about 230 ft. of the tunnel were through solid rock, which stood without timbers. The tunnel was at first worked by the company itself, with a bottom heading, but the contractor afterwards abandoned that heading and started a top heading from both ends. The connection between the two headings was made on the 31st of January, 1881, at a distance of 1,888 ft. from the lower portal. The deviation of the survey was 0.24 ft. in length, 0.02 ft. in elevation and 0.04 ft. in alignment. The whole work was done by hand labor only; the drifts had a cross-section of 64 sq. ft in timbered ground and of 97 sq. ft. in solid ground. In the first case four men (12 hours' shift) worked in the face, in the latter case six men. The total number of cubic yards excavated was about 68,050. Only very little water was encountered. Ventilation was procured by fans worked by small turbines. The temperature in the face shortly before the connection was 82° F. in the lower header and 64° F. in the upper header, the outside temperature being respectively 37° and 41°. During the winter of 1880 the natural ventilation was sufficient, so that the artificial one could be abandoned in the upper heading. The average daily progress of the headings when the work was done by the contractor was 1.68 ft. in the lower heading and 1.64 ft. in the upper heading.

The Leggistein Tunnel is the second circular tunnel of the development near Wasen and forms a curve of 5¼°; it is 3,605 ft. long, and was worked from both ends with a top-heading. In the beginning the ground was very hard, solid granite gneiss, which further in changed into favorable mica-schist.

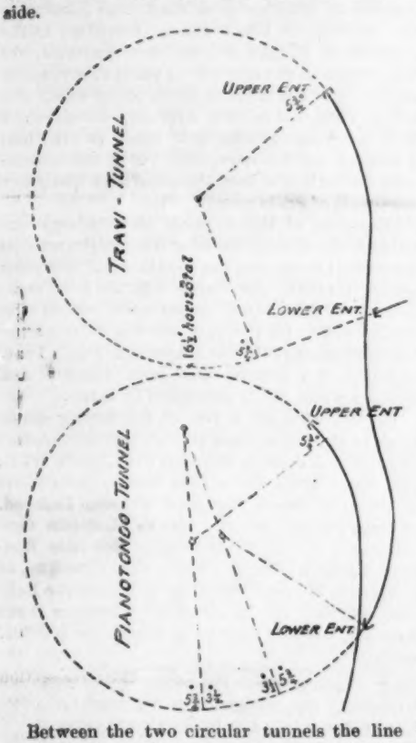
The rapid fall of the river Tessin in the neighborhood of the gorge of Dario—on the south side of the Gothard—prevents the railroad line from keeping in the bottom of the valley, which is the only practical ground for a railroad; it necessitated the development of the line by means of "raising curves" and circular tunnels. The river falls here 551 ft. in 7,875 ft. The grade being in one section 528 ft. per mile and in another one 316 ft. per mile. Two circular tunnels—the upper one on the left bank of the river and called Freggio Tunnel—the other on the right river-bank and called Prato Tunnel—serve to obtain the necessary length to overcome the steep grade in the river. The grade of the railroad is in both tunnels 121.5 ft. per mile, while th at of the open line is 187.3 ft. per mile.

The Freggio Tunnel is 5,125 ft. long. The first 269 ft. of the upper heading traverse the débris of a mountain slide containing immense blocks with a large influx of water. The pressure of this piece of ground was considerable; an arch of from 2 feet to 3 feet in thickness supports the roof. The balance of the tunnel runs through medium and very hard quarzitic gneiss with more or less regular strata. The tunnel was worked by the so-called "Belgian" method, with a top heading from both entrances. The work in the upper heading was very troublesome on account of the heavy ground and the large amount of water. Most of it was done by hand labor alone, and only during the last 4 months machine drilling was introduced. Three machines worked one shift per 24 hours, making in 135 days 660 ft. of heading, or in 24 hours 4.9 ft., while by hand labor—3 shifts in 24 hours—only 2.3 ft. were made. The drills used were Frohlich drills. The compressors, being common for both tunnels, were worked by water-power, 280 horse-power being at disposal; the air-pressure was equal to 67 lbs. The lower heading was first worked by hand—three shifts—471 ft. being made in 218 days, or averaging 2.13 ft. per 24 hours. On October 20, '79, machine drills were introduced in two shifts, per 24 hours; from that day until December 16, '80, 3 machines were used in the face, thereafter 4; and from February 19, '81, to April 28, '81, 5 machines on 3 columns. 2,875 ft. were made in 545.5 days, or 4.26 ft. per 24 hours. The average daily progress of this heading during the first four months was 3 ft. with 3 drills; during the following 11 months was 5.25 ft. with 3 drills; during the last 4 months was 7.50 ft. with 4 to 5 drills.

The Prato Tunnel is 5,108 ft. long. The rock was mostly micaecous schist, with nearly horizontal stratification; only 2,300 ft. were through sufficiently solid ground to stand without timbers. It was also worked from both ends with top-headings. The upper heading was worked by hand labor only, while the lower one was worked partly with three Frohlich drills and partly by hand. The average daily progress by hand labor in the upper headings was 2.6 ft., and in the lower one 2.46 ft., and by machine-drills 4.6 ft. The hand labor was partly done in three 8 hours' shift, partly in four 6 hours' shifts; the average monthly progress in the first case was 69 ft., in the second case 87 ft. The cross-section of the upper heading was nearly 107 sq. ft., with 10 men in the face. The cross-section and number of men in the lower heading varied according to the ground. The connection of the two headings was made at a distance of 2,184 ft. from the upper portal; and the deviation of the survey was 0.04 ft. in alignment, 0.06 ft. in length and 0.025 ft. in elevation, while the deviation of the surveys of the Freggio Tunnel was 0.32 ft. in alignment, 0.09 ft. in length and 0.08 ft. in deviation. No artificial ventilation was needed in the upper heading, but the lower heading was ventilated by compressed air. The influx of water was very small.

The most southerly development of the line by means of circular tunnels is that in the so-called Biaschina between the villages of Lavorgo and Giornilo, where the river has a fall of 378 ft. in a distance of 3,300 ft. The grade of the railroad necessitates a length of 15,910 ft. to overcome this sudden descent. The two circular tunnels are both on the left bank of the river Tessin and approach each other horizontally within 16.5 ft. The upper tunnel is called Pianotondo, and the lower one Travi tunnel. The approach to the Pianotondo, Tunnel required the construction of an iron bridge, 4 spans, each 84 ft, long, with 3 piers of from 85 ft. to 92 ft. in height, the whole located on a curve of 5¾°. The upper portal of the tunnel is at an elevation of 1,823 ft. above the sea and 342 ft. above the river, while the lower portal is only 33 ft. above the river. The tunnel is 4,950 ft. long, and lies in a compound curve of 3 radii, namely, 3,844 ft. in a curve of 6°, 451 ft. in one of 3½°, and 655 ft. in one of 6°. The grade is 121.5 ft. per mile. Both headings—top headings—were commenced by hand-labor until the preparations for the machine drilling were completed, which was done on Nov. 10, 1879; Frohlich drills were used. The machine drilling in the lower heading was first done with 3 and then 4 drills and was so continued without any interruption until February 10, 1881, while in the upper heading it had to be abandoned very frequently on account of the large flow of water, which several times drowned out the heading en-

tirely; 246 days were thus lost there. When worked by hand the cross-section of this heading was 48 sq. ft., with from 6 to 8 men in the face, but when worked by machines it was enlarged to from 60 to 65 sq. ft. (three machines). The machine drilling in the lower heading resulted in an average daily progress of 5.25 ft. With the exception of the first 69 ft. of the upper heading, which required timbering, the ground consisted of a grayish, finely-grained gneiss, rich in mica, with well-defined strata and an ample influx of water, which was directly influenced by the weather outside.



Between the two circular tunnels the line is about half a mile long, and contains, besides a tunnel of 236 ft. in length, an iron bridge of three spans of 65 ft. each, on a curve of 5¾°.

The upper portal of the Travi Tunnel is at an elevation of 1,625 ft. above sea, and 200 ft. above the river, while the elevation of the lower portal is 1,510 ft. above sea and 39 ft. above the river which immediately below this portal is crossed by means of an iron bridge of 157 ft. span. The tunnel is 5,070 ft. long, 4,410 ft. of which lie in a curve of 5¾ degrees, while the remaining 660 ft. are on a tangent. Like the Pianotondo Tunnel this one was also first commenced by hand labor in both headings. The machine labor was begun in the lower heading on November 4, 1879, and in the upper heading on July 20, 1880, with three Frhlich drills in each. The total length made by hand labor was 1,510 ft. (cross section of drift 64 sq. feet), and by machine labor was 3,560 ft. (cross-section 70-75 sq. feet). 3,542 were driven from the lower side and 1,528 ft. from the upper.

The progress by machine drills in the lower heading was 4.9 ft. per day.

The rock in this tunnel was gneiss, rich in feldspar and quartz of a white color, coarse-grained and very hard. The flow of water was considerable; siphons were employed to drain the upper heading. Only about 985 ft. of the heading required timbering.

The last tunnel of importance toward the south is the Monte Cenere Tunnel, on the branch from Bellinzona to Lugano. It is 5,495 ft. long; the first 1,770 ft. from the north portal lie in a curve of 4¼°, the balance is on a tangent. The grade is 119 ft. per mile, ascending from the north to the south portal. The latter is 1,560 ft. above the sea. Until April 25, 1880, both headings were worked by hand, the north heading with six men and the south heading with four men, in eight hours shift. On April 28, 1880, the machine labor commenced in the north heading, whilethe south heading was driven by hand entirely. The drills used were those of the St. Gothard Tunnel, of the McKean-Séguin type. Four of them worked on a carriage. Two compressors, 22x30 in., driven by water-power, delivered in one hour with thirty revolutions per minute 4,800 cu. ft. of air at a pressure of 67 lbs. This required 120 horse-power. The compressors were located 1.5 miles distant from the portal. The diameter of the air-pipe for this length was 4¾ in.; inside the tunnel it was reduced to 3¼ in. Two air receivers were situated close to the tunnel entrance; 3,700 ft. of heading were driven by machine labor in 332 days, equal to a daily aver age of 11.1 ft.

This required the drilling of 77,450 ft. of drill-holes, which is equal to a daily performance of 58.4 ft. by one machine. The maximum daily progress was 19.3 ft., while the maximum monthly progress was 407 ft., the minimum being 200 ft. The gelogical features of the tunnel were favorable, the rock being all through a sufficiently solid gneiss and mica-schist, very rarely requiring timbering. Very little water was met with.

All of the tunnels required masonry for shorter or longer distances. The width and height of a double track tunnel is 26.2 ft. and 19.7 ft. respectively. All tunnels were laid out for a double track, but the larger portion of them were not broken out to the full dimensions, but only for a single track, leaving the enlargement for the time the traffic should require a secend track. Sketch No. 3 shows the method adopted.

NOTE.—The compiler of the above paper has prepared a most interesting and detailed tabular statement (reduced to English measures) showing the relative progress made at the different tunnels and by the different systems followed. Interested parties can obtain these tables by application to Geo. J. Specht, C. E., Room A, 418 California St. San Francisco, Cal. [ED. ENG. NEWS.]

THE PALESTINE CANAL.

A lecture, entitled "Jerusalem: Past Present and Future," was delivered on the evening of the 8th at the Methodist Episcopal Church in Forsyth street, this city by the Rev. John P. Newman, D. D LL.D. After a lucid and exhaustive account of the various casualties that befell the sacred city in ancient times, and a brief history of its distinctive characteristics and of the many memorable sites within its walls, the speaker, in alluding to the glorious future that lay before Jerusalem when the restoration of the worthy remnant of Jews took place, said, with reference to the proposed Jordan Canal: "A certain gentleman, called 'Chinese Gordon,' who is a great soldier, a skillful engineer and a man of long and varied experience on many matters, is exerting himself to the utmost to help the Lord in fulfilling a notable prophecy. Now, we all know how Rebecca and Sarah got into disagreeable domestic broils and a general state of discomfort by desiring to give the Almighty similar aid. My advice, then, to this, 'Chinese Gordon,' whose great ability I am quite ready to acknowledge, is to keep his fingers from tampering with biblical prophecies, for he may take my word for it that the Lord will, in His own good time, fulfill whatever he has foretold, and is not dependent on human engineering to send a river rushing into the valley of the Jordan."

PALESTINE RAILROAD.

BOSTON, Nov. 8, 1883.

Judge Holmes to-day granted an order dissolving the Palestine Railroad Company. This road was orignally designed to run from Cairo, Egypt, to Jerusalem. It was intended as an easy and quick means of access to the Holy Land, and partook of a religious character, not being incorporated for the sole purpose of making money. Its originator and chief supporter, the Rev. J. A. Smith, dying, the scheme was abandoned.

THE NEW RAILROAD TIME.

The adoption, on Nov. 18, of the new standard of time by the railroads of the country will necessitate a change in the local time along the lines affected. Mr. W. F. Allen, the Secretary of the conventions which order this new departure, has furnished the following schedule of the change in time to be made on each road. The letter f denotes that the clock is to be set ahead, and the letter s that it is to be set back.

Atchison, Topeka & Santa Fe, east of Dodge City, clocks only. 9 minutes f.

Atchison, Topeka & Santa Fé, west of Dodge City, clocks and schedules, 51 minutes s.

Baltimore & Ohio (west), both clocks and schedules, 28 minutes, s.

Boston, Hoosac Tunnel & Western, both clocks and schedules, 4 minutes, s.

Boston & Albany, clocks only, 16 minutes, s.

Canadian Pacific (Eastern division), clocks only, 6 minutes, s.

Central Vermont, both clocks and schedules, 12 minutes, s.

Chesapeake & Ohio, both clocks and schedules, 8 minutes, f.

Chicago & Alton, clocks only, 9 minutes, s.

Chicago & Grand Trunk, both clocks and schedules, 9 minutes, s.

Cleveland, Columbus, Cincinnati & Indianapolis, both clocks and schedules, 28 minutes, s.

Delaware & Hudson Canal Company, clocks only, 4 minutes, s.

Delaware, Lackawanna & Western, both clocks and schedules, 4 minutes, s.

Fort Wayne, Cincinnati & Louisville, both clocks and schedules, 23 minutes, s.

Freehold & New York, both clocks and schedules, 4 minutes, s.

Hartford & Connecticut Western, clocks only, 4 minutes, s.

Lake Shore & Michigan Southern, both clocks and schedules, 28 minutes s.

Lehigh Valley, clocks only, 1 minute f.

Louisville & Nashville, clocks only, 18 minutes, s.

Missouri Pacific, clocks, schedules at St. Louis only, 8 minutes, s.

New York, Lake Erie & Western, clocks only, 4 minutes, s.

New York Central & Hudson River, clocks only, 4 minutes, s.

New York City & Northern, clocks only, 4 minutes, s.

New York & New England (east of Connecticut), both clocks and schedules, 14 minutes, s.

New York & New England (in Connecticut), both clocks and schedules, 4 minutes, s.

Pennsylvania, New York division, both clocks and schedules, 1 minute, f.

Pennsylvania, all divisions except New York, clocks only, 1 minute, f.

Philadelphia & Reading, both clocks and schedules, 1 minute, f.

Rome, Watertown & Ogdensburg, clocks only, 4 minutes, s.

COAL-SLACK FOR BALLAST.

THE MISSOURI PACIFIC RAILWAY COMPANY,
OFFICE SUPERINTENDENT OF BRIDGES AND BUILDINGS.
PACIFIC, MO., Nov. 2, 1883.

EDITOR ENGINEERING NEWS:

We are using on our road a considerable amount of cinders and coal-slack for ballast; the question has come up as to whether this ballast is destructive to ties or not. Will you please give me through the medium of your next issue the facts in regard to this point? Yours truly,

R. M. PECK, Sup't B. and B.

[This is a question upon which we have no data for answering, but we would be pleased to publish anything that our correspondents may have to say upon this subject that is of general interest.—ED. ENG. NEWS.]

RAILWAY PROGRESS.—The Ohio Valley will be connected with the Cleveland & Pittsburgh in a few weeks, but no progress will be made South. ....The Flint & Marquette has been extended to Houghton Lake....The Witchita & Western is finished to Kingman. The engineer corps are between the latter place and Dodge City....The Columbus & Cincinnati narrow gauge will be built by the New York Construction Company. Steel rails will be laid....The Illinois & Eastern Division of the Central Iowa have been connected at the Mississippi....The Pennsylvania, Erie and New York moved 5,756,422,000 tons of freight one mile in 1875, and in 1882, 11,118,811,000 tons—an increase of nearly 100 per cent.

THE Long Branch Pier has been sold to the New Jersey Central for $97,500. The railroad company will tear it down.

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AND
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SEVERAL riots among Italian and Hungarian railroad laborers have occurred lately. In some cases it would seem that contractors did not carry out their engagements as punctually as was desirable. At the same time there is no doubt that the pistols and knives of the green immigrants may be used some day with bad effects.

WE give the "prospects" of the new overland railroad, the U. S. Central, as we find them in the San Francisco *Chronicle*. More than is stated there we know not. The list of subscribers apparently contains some good names, and if these gentlemen are willing and able to back up their convictions with the $50,000,000 of capital mentioned, we see no reason why we should not have another through line to the Pacific.

Our interest in the matter lies in the "prospects" for work offered to our engineering subscribers, who just now seem to be none too busy; and in their interest we will keep our readers posted upon the future movements of this new organization.

"THE TECH."

A new face, among our exchanges at least, is that of *The Tech*, a bright, handsome semi-monthly, published by the students of the Massachusetts Institute of Technology. The board of direction and the editors are students of the Institute. The contents are made up of matter relating to the world in general, and the college world in particular. Technical notes and current fun are mixed in a way that is at least very readable. The illustrations are good, and the little remarks upon and hits at the doings of the day are often witty and most decidedly pointed. Taking it all together, the production is very creditable to the enterprise, taste, and native talent of the institute.

BUILDING.

Mr. Comstock is to be congratulated upon the contents and general appearance of his special illustrated edition of "Building." This is a new publication, to be issued monthly in connection with the "Building" proper, and will contain, in addition to the matter appearing in the latter, lithographic reproductions of the best designs from the foreign journals.

If we can judge what is to follow from the contents and selection of subjects for No. 1, we have no doubt that this new venture will be appreciated by the architectural and building public, and prove financially successful to its publisher.

FIFTH ANNUAL MEETING OF THE MICHIGAN SOCIETY OF SURVEYORS AND ENGINEERS.

At a meeting of the Executive Committee held in East Saginaw, October 19, it was decided to have the next meeting open at 2 p. m. January 1, 1884, and continue in session until January 5, at East Saginaw. The following programme was adopted: Address of Welcome, Reports of Committees, Papers on Drainage, Railroad Earthwork, Narrow-Gauge Railroads, Temporary Railroad Bridges, Water-Works, Necessary Legislation, Mechanical Engineering, Questions in Practice. One evening will be given up to a banquet and one forenoon to an excursion. An exhibit of instruments is also provided, and manufacturers will be given an opportunity to explain the merits of their instruments. The papers will be read by the ablest engineers and surveyors of the State. Applications for membership from Messrs. Law, Rogers, Topling, Mitchell, Dean, Hastings, Mills, Shoedde, Kuan, Coats and Prof. M. E. Cooley, were favorably considered. A change is recommended in the constitution so as to admit mechanical engineers.

BOOK NOTICE.

EXPLOSIVE MATERIALS; a series of lectures delivered before the College de France, at Paris, by M. P. E. Berthelot. Translated by Marcus Benjamin, Ph.B., F. C. S.; to which is added a short historical sketch of gunpowder, translated from the German of Karl Braun by Lieut. John P. Wisser, U. S. A.; and a Bibliography of Works on Explosives.

The work just issued under the above title is No. 70 of the Van Nostrand Science Series. The first part, being originally in the form of class lectures, embodies the latest accepted theories upon the force of explosives, and discusses the chemical composition, the reactions, molecular rapidity, etc., of both slow and quick burning modern explosives.

The historical sketch is interesting and pretty thoroughly disposes of the long-accepted claims of Berthold Swartz, the Freiburg monk, as the original inventor of gunpowder.

The Bibliography of Works on Explosives embraces over four hundred titles, and is in itself a valuable acquisition to the student in this especial branch of the sciences. [Price, 50 cents.]

NEW BOOKS.

Plaster and Plastering, Mortars and Cement; How to Make and How to Use. Being a complete guide for the plasterer in the preparation and application of all kinds of plaster, stucco, Portland cement, hydraulic cements. With useful and practical information on the chemistry, qualities and uses of the various kinds of limes and cements. Together with rules for measuring, computing and valuing plaster and stucco work. To which is appended an illustrated glossary of terms used in plastering, etc. By Fred. T. Hodgson. Published by the Industrial Publication Company of New York.

The title of the above work is so full within itself that little room is left us for a description of its contents. We would only add that the author's name, already well and favorably known by his published trade manuals, is a sufficient guarantee for the completeness of the present work. As near as we can judge, Mr. Hodgson has covered every contingency known to the plasterers' art, and has so expressed himself that any novice may understand. As no book will make a man a competent mechanic, without experience and handicraft, the author offers this work simply as a help to those who wish to help themselves; and, viewed in this light, it should be acceptable and invaluable to the man who wishes to advance, and advance rapidly, in the plasterer's trade.

THE BROOKLYN BRIDGE CASE.

The case of Abraham Miller against the Trustees of the Brooklyn Bridge was argued before the Supreme Court on November 6. The purpose of the suit has already been given in ENGINEERING NEWS, and the complainant's case was originally dismissed with costs, in 1876, by the United States Circuit Court; the present argument is upon an appeal.

The justices in the present case, as far as it has proceeded, evidently do not agree with the reasoning of the plaintiff's lawyer, and Justice Miller suggested that he was wasting time in arguing the question whether an obstruction not authorized by Congress or a Legislature would be a nuisance or not. "The question here is, What has Congress said or done with regard to this subject?" The lawyer did not care to put himself upon record as demanding a bridge so high that it would not interfere with any ship that *might* be constructed.

The attorney for the trustees argued that the plaintiff had shown no special injury; that he had slept upon his rights for seven years, and thereby forfeited any claims; and that upon the evidence the bridge, as constructed, does not in the sense of the act of Congress "obstruct, impair or injuriously modify" the navigation of the East River.

The case is not yet concluded.

THE PROJECTED RAILROAD TO THE SUMMIT OF PIKE'S PEAK.

We learn from the *Daily Gazette* of Colorado Springs, that a company has been organized, with the Hon. James H. Kerr, as president, for the purpose of building a railroad from Manitou to the summit of Pike's Peak. According to the report of W. F. Ellis, Jr., the chief engineer, the total length of the line will be about thirty miles, and the maximum grade 300 ft. to the mile. The rolling stock will be built expressly for the work to be done; parties being now ready to enter into a contract for the construction of 20-ton locomotives guaranteed to haul 100 passengers under the conditions of grade named.

The report of the engineer includes some statistics of interest, as showing the grades overcome upon other roads, and the popularity of this point among tourists. He claims that the hotel registers show that 60,000 people have visited this section within the last year and that of this number 5,000 ascended to the summit of Pike's Peak, although the present route is a difficult and dangerous one, rarely attempted by ladies.

The following are a few of the narrow gauge roads in the country operated over heavy grades: Wahsatch & Jordan Railroad, Utah, grade 287 ft. per mile; Rising Fawn Iron Works, Georgia, 316 ft. per mile; Green, Marquis & Johnson Railroad, of Pennsylvania, 395 ft.; Hawks Mountain Coal Company, W. Va., 348 ft.; Poplar Mountain Railroad, Kentucky, 300 ft.; Soddy Coal Company, of Tennessee, 396 feet; Pennsboro & Harrisville Railroad, W. Va., 270 ft. Over the American Forks Railroad, Utah, 47 tons were hauled on a 300 ft. grade.

THE HARDENING OF SOFT CALCAREOUS STONE BY MEANS OF FLUO-SILICATES WITH A BASE OF INSOLUBLE OXIDE.

BY MM. FAURE AND L. KESSLER.

[Translated for Engineering News from *Compte Rendu des Travaux*, etc.]

The employment of alkaline silicates in the hardening of calcareous stone is at present far from being satisfactory. The resulting effect is a stone impregnated with soluble salts which never leave it even after long exposure to the rain. These salts, potash or soda, have a tendency toward nitrification and, moreover, encourage the growth of moss and other vegetation for which potash is a fertilizer.

Builders have vainly sought to guard against these evils by a terminal wash of hydrofluosilicic acid with a view of rendering insoluble the potash in the silicate of potash used; but in addition to the difficulty of precipitating one salt by another in the interior of a stone, is the impossibility of exactly fixing the proportions desired. The required reaction may fail from the alkaline fluosilicate formed, being itself decomposed by the carbonate of lime and carbonic acid, fluoride of lime, silicic acid and carbonate of potash to such an extent that the final result is the same as before the application.

Another great inconvenience in the use of alkaline silicates is the fact that by evaporation they form an impervious varnish upon the surface of the stone the moment absorption ceases. The result is, with a stone still containing its "quarry water" or otherwise saturated, in greater or less quantity, that this water will be shut up within the stone by the varnish. If freezing follows, the imprisoned water will expand and scale off the varnish with whatever stone adheres to it.

It is not then to be surprised at that the use of alkaline silicates is not spreading.

Any desirable process for hardening stone should leave within the stone only insoluble and durable material; above all things it should not expose the stone to the danger of being scaled off by frost. The result sought for is obtained by the use of

soluble fluosilicates, in which the oxides or the carbonates are insoluble and in a free state.

If any soft limestone is saturated with a concentrated solution of fluosilicate of magnesium, of aluminium, of zinc or lead, a very hard coating of considerable thickness will be formed, which contains no soluble material.

We have in fact, along with the carbonic acid liberated, only *spath fluor de la silice*, the oxide of aluminium, some carbonates of zinc, or may be lead, or fluoride of magnesium; all less soluble than the limestone itself. No impervious surface varnish can be formed and consequently the stone is not exposed to danger from frost.

Silicification by these new agents is not any more costly than by the silicates. The process has stood perfectly the test of winter. They have also developed unexpected advantages. It is not always sufficient to simply harden a soft stone—it may be desirable to also give it the appearance and polish of a hard stone, if only to avoid the possibility of dust or soot darkening or soiling the rough surface.

To smooth and polish a rough stone, it is only necessary to cover the surface with a paste made by mixing some of the same stone with water, then, after this coating has become dry, impregnating it with the same fluosilicate used in the hardening process. This covering forms a homogeneous fine grained mass and becomes as hard as the stone itself. Some simple precautions should be taken to prevent the lifting of this applied stone-dust by the action of the carbonic acid liberated at the commencement of the operation. To this end the paste should be first applied in very thin layers, and the surface of the stone should be quite dry. If an insoluble color is mixed with the paste a mottled surface or a decorative design of some kind can be obtained, which in certain cases might be very effective.

By using fluosilicates colored by bases of copper, chrome, or iron, the stone itself will be deeply colored in the formation of the insoluble compounds. This coloring matter will sometimes react differently upon the separate parts of the mass, and in revealing what we might call the anatomy of the stone, often produce very artistic effects. And by combining these different methods of treatment different kinds of marble or ornamental stone can be readily obtained.

CHEAPER GAS FOR AMERICAN CONSUMERS.

At the eleventh annual meeting of the American Gas Light Association, held in Teutonia Hall, New York, Oct. 17 and 18, the President, Mr. Theobald Forstall, in his address commenced by stating that the introduction of the electric light, instead of destroying the manufacture of gas, as at one time feared, has really proved a most active stimulant to its use. He looked forward hopefully to the day when fuel will be furnished to the consumers as well as light, through the existing system of gas-mains; and was encouraged in this hope by the steady rise of late years in the cost of petroleum. With the price of 16-candle gas brought down in our large cities to $1 per 1000, he believed that the ill-smelling, troublesome and dangerous oil lamps and stoves would soon be banished from every household.

Mr. Forstall remarked that the first step in securing good gas at cheap rates is the immediate cessation of grants, by City Councils or the Legislatures, to competing companies. The effect of such action is generally the enriching of a few dishonest public officials, at the ultimate expense of the consumer and the corporation. The gas companies established without guarantees, and subject to the whims of councils and the cupidity of rings, appreciate the uncertainty of their position, and, by high prices and poor gas, swell their profits so that they may be prepared for the inevitable struggle with their masters. Moderate dividends, well secured over a term of years, are more attractive to investors than large but uncertain profits, that may be swept away at any moment by the unexpected vote of a few aldermen. The president supported his argument for non-competition by referring to the disastrous effects of the free-trade principle, which brought thirteen competing companies into the field in London, at one and the same time, in 1845. One company only paid a dividend, and that only 1½ per cent. After this experience the district system was adopted, in which each company held the exclusive right of supply in its district.

"The Metropolis Gas Act" was passed by Parliament in 1860 for the protection of consumers, and while this act approved of the limiting of each company to its especial district, it fixed the maximum price of 12-candle gas at 4s. 6d. per 1,000 feet, with power to the Home Secretary to grant an increase to 5s. 6d. in case the necessity should arise. The supply of gas was made obligatory, and a standard of purity and illuminating power was fixed. The dividends, too, were limited to 10 per cent., and all surplus revenue was to be devoted to a reduction in the price of gas. From the passage of this act an era of uninterrupted prosperity began for all the London companies. Under the act successive slight reductions were made, but the incentive was still lacking in the law for a reduction in the cost of manufacture. This omission was at last supplied by the introduction of the sliding-scale system, first proposed by George Livesey, Secretary and Engineer of the South Metropolitan Co., and incorporated in an Act of Parliament in 1876. Under this plan an initial price is fixed for each company, after a thorough investigation of all its circumstances, which shall enable it by "good management" to earn 10 per cent. upon its capital and keep up its reserve. If, however, by better management, it can reduce the price to consumers below the initial price, it is allowed to increase its dividends in a certain fixed ratio above the 10 per cent.; thus dividing with the consumer the profits of economy. The most happy results have followed its adoption, though the project was at first vigorously opposed, and Mr. Livesey regarded as a traitor to the cause. One result has been the consolidation of the companies; instead of thirteen there are now only two, and the price has been reduced to 3s. 2d. and 2s. 9d. respectively, with an increase of dividends to 11 and 12 per cent. The latest accounts point to an early consolidation of these two companies into one corporation, with a capital of $50,000,000, and an annual sale of 18,000 million feet of gas at 70 cents per 1,000 feet.

Mr. Forstall regretted that this English experience has been wasted upon us, and said that New York, with six companies in the field with a capital of $22,000,000, and a seventh preparing to enter, could supply the whole area of Manhattan Island with a capital not exceeding $15,000,000. The annual loss to consumers at 7 per cent. on the excess capital is $490,000, in addition to the increased cost of gas due to the maintenance of six separate staffs of officers, with double, treble, and sometimes quadruple, systems of mains in a single district. This single company could afford to sell 16-candle gas at $1 per 1,000 feet, and still pay ten per cent. dividends. He thought the total saving in such case would not be less than $5,000,000 per annum to the people of New York.

To prove this statement the following figures were given:

The Chartered and South Metropolitan Co., of London, has a paid-up capital of $47,000,000, sells annually 17,000 million cubic feet of gas, or at the rate of $2,765.00 of capital per 1,000 cubic feet sold. The average price is 77 cents per 1,000 cubic feet. The net profit, in round figures, is $5,750,000, or a little more than 12 per cent. on the entire capital.

Assuming that the present gas consumption of New York is 5,000 million cubic feet per annum, and allowing a capital investment of $3 per 1,000 cubic feet sold, one single company would have to earn dividends upon $15,000,000. What profit would it make at $1 per 1000 cubic feet for 16-candle gas?

For the first half of 1883 the cost of gas delivered by the South Metropolitan Co. was $39\frac{85}{100}$ cents, and by the Chartered Co. was $44\frac{88}{100}$, the average being 43 cents on the whole quantity sold by the English companies. Of the items making up this cost, two only are lower than the corresponding items in New York—viz., coal and labor. The net cost of coal, less residuals, was over $9\frac{82}{100}$ cents per 1,000 feet sold for the South Metropolitan, and $13\frac{33}{100}$ for the Chartered Co. In New York the greater cost of coal and lower value of residuals would bring the net cost of coal up to 25 cents per 1,000 feet. The cost of labor to the English companies was $9\frac{11}{100}$ and $8\frac{35}{100}$ respectively. This in New York could be amply covered by 15 cents per 1,000 feet.

To a single company, then, supplying all New York the cost of 16-candle gas would be as follows:

Coal, net cost per 1,000 sold, less residuals	$0.25
Labor and superintendence per 1,000 sold	.15
Retorts, purifying material, etc	.05
Cost in holder	.45
Repairs, distribution, taxes and general expenses	.20
Total cost delivered per 1,000 sold	.65

The profit would be 35 cents per 1,000, or $1,750,000 per annum—say 11 $\frac{66}{100}$ per cent. Ten per cent. dividends could be paid and the difference kept for a reserve. An addition of 25 cents per 1,000 would pay for 25-candle gas, and still leave a margin of gain of $1 per 1,000 feet to consumers at the present rate of $2.25.

Among the advantages which would accompany the adoption of the English gas legislation would be the publication of Company accounts in such form as to exhibit the actual cost and profits of the business. It would put a stop to excessive dividends at the cost of the consumer. Patented methods would be thoroughly tested, adopted if good, rejected if worthless. It would create a spirit of emulation looking toward economy in manufacture among the officials of different works. It would give the securities a higher standard among investors, with the accounts open to inspection. And the publication of such accounts would establish beyond a doubt the relative cost of coal gas and water gas, candle for candle.

The principles embodied in the English legislation upon this subject are:

1. Exclusive and obligatory supply secured to established companies.

2. Initial price sufficient to earn 10 per cent. upon structural value of plant, with sliding scale of dividends.

3. Purity and candle power regulated and efficiently tested, with penalties for infractions.

4. Annual publications of accounts.

Mr. Forstall doubted whether, at the present day, it would pay to provide special plant for a purely heating gas. He thought, however, it would be profitable in cities of 100,000 or over. A non-illuminating, unpurified water gas could be put into the holder for 15 cents per 1,000, distributed for 10 cents more, and sold at a fair profit at 40 cents per 1,000 ft. Such gas possessing one-half the calorific power of ordinary coal gas would, at that price, be equivalent in cost to the consumer to coal gas at 80 cents per 1,000. It would be preferred to solid fuel for many uses, for which illuminating gas is now too expensive.

In concluding his address the President remarked that it may seem Utopian folly to hope for any speedy settlement of the gas question in this country upon the lines suggested. The adjustment of this matter would take time, and an effort that can only be effectively made by the companies themselves. He trusted to the common sense of his fellow citizens, after the truth has been fairly driven home to their minds and their pockets, to convince them that one well-regulated and well-managed company will furnish better and cheaper gas than a multitude of irresponsible and uncontrolled corporations.

A NEW JOURNAL.

The Journal of Commerce, Wood-Worker and Machinist, Vol. 1, No. 1, has appeared. It is a monthly, published in Philadelphia by Jno. H. Bentley, and is devoted to the interests of both

makers and users of wood-working machinery, being the only publication of this nature in the East. It is a handsome paper, well printed and well illustrated with cuts of some of the newer inventions among the class of machines to which it is especially devoted.

The publisher evidently thinks there is room for another class paper, and truly remarks that such a journal is the best advertising medium, for while its circulation may be comparatively small, it goes directly to the class of trade that it is desirable to influence, and so really does more good to the advertiser than a display in a more widely spread sheet that *may* not reach this class at all.

THE AMERICAN SOCIETY OF CIVIL ENGINEERS.

A meeting of the Society was held on Nov. 7, about 30 members present. The following new members were elected :

THOMAS NORTON BAILEY, 1st Lieut. Corps of Engineers, U. S. A., Charleston, S. C.

HENRY WALLER BRINCKERHOFF, Civil Engineer-Brooklyn, N. Y.

EBENEZER SMITH WHEELER, Gen. Sup't St. Mary's Falls Canal, Sault Ste. Marie, Mich.

The deaths during the past month were announced of Mr. Henry Farnum, Fellow of the Society, and Mr. Thomas J. Seely, Member of the Society.

The paper of the evening was "A Description of a Combined Triangular and Suspension Bridge Truss, and comparison of its cost with that of the Warren, Pratt, Whipple and Howe Trusses," by Edwin Thacher, M. Am. Soc. C. E. Mr. Thacher's contribution, though too voluminous to be given here, even in part, was ably prepared and valuable from the amount of statistical information contained in it. One of the chief points made, however, was that the comparative economy and efficiency of the combination bridge of wood, iron and steel was not sufficiently recog nized by engineers. He claimed that it was cheaper in first cost, and, taking the average life of an iron bridge at 30 years, was quite as durable as those constructed wholly of iron and steel. The author's paper was illustrated by diagrams of a combination bridge invented by him, on the triangular suspension principle. In this bridge the usual counters are omitted, and, as claimed by the inventor, no adjustment is necessary in the tension members for length. The arguments advanced as to cost, etc., were supported by carefully prepared comparative estimates of a 520-ft. span, one of the combination type proposed, the other an iron and steel Whipple truss; the cost of the first was shown to be $181.96 per lineal foot as opposed to $203.30 for the last.

Mr. Theo. Cooper, in discussing this paper, while he recognized the labor involved in its preparation and its general interest to the profession, differed from the views advanced by its author. He remarked that the tendency of modern bridge builders was always toward a simplification of parts, directness of strains, and a minimum of connections; the combination bridge, as presented, was complicated in its connections, and difficult and uncertain in its calculations. The use of wood and iron together in any framed structure made absolutely necessary ample provisions for adjustment in the iron members; these adjustments were not deemed essential in the author's bridge. As Mr. Cooper remarked, it was impossible to bring a wooden member as exactly to required dimensions of length as would be the case with iron prepared in the shops; this is especially true if the wood was prepared upon the ground, as is usual, with a carpenter's axe and saw, and fitted there to castings, etc. The author's estimate of the duration of the wooden bridge as compared with iron would be considerably modified if the risk from fire, to the former, were considered.

Mr. Chas. Macdonald remarked that, while counters were technically omitted in the author's design, their duty was actually performed by certain of the suspension members in the truss; but that owing to the small angle made by some of these members there was a decided lack of economy in the arrangement proposed. Mr. Macdonald thought that 30 years was not a fair estimate of the lifetime of a modern iron bridge. He admitted the statement made by Mr. Thacher, that on some of our railroads the third generation of iron bridges was now in use, but explained this by the fact that, in the time covered, the railroad companies had doubled, trebled, and in some cases quadrupled the weight of their rolling stock. As a fact in point he mentioned that the Penna. R. R. had, within the last six months, increased their specifications for rolling load from 2,240 lbs. per lineal foot preceded by one consolidation engine, to 3,000 lbs. per lineal foot, headed by three locomotives of different types, requiring special strain diagrams for each class. In comparing bridge designs for economy, especially in long spans, a very important factor in the problem is the erection; an expensive type of truss may really be cheaper in certain localities than a more simple form when the risk of erection is taken into consideration; and this risk certainly figures in the estimate of profit and loss. For this reason the cantilever bridge is gaining in favor.

Mr. James D. Schuyler, Chief Engineer of the Sinaloa & Durango R. R., and member of the society, presented an interesting collection of forty-five different species of Mexican woods, together with a schedule of their names, uses and location. In the talk following the presentation and examination of these woods mention was made of a rather extraordinary bit of railroad construction near Sinaloa, Mexico, in which the rails were laid on ebony ties and the road ballasted with silver ore. Mr. Schuyler, under whose direction this anomalous road was built, remarked that the rails were only spiked to the ties after extensive experimental work; all wood at their disposal was hard wood, and the spikes could only be put in after holes had first been bored. In the case of the ebony ties, the final results of their experiments required the boring of a hole $\frac{5}{8}$ in. in diameter for a spike $\frac{1}{2}$ in. square; a somewhat smaller hole would permit the driving of the spike by about 20 blows from a 12-lb. spike-maul, but it was then impossible to draw the spike again with a claw-bar. The holes had to be bored the full length of the spike; not even an eighth of an inch could be allowed for point penetration into the solid wood. An auger with a very coarse entering-thread was found to be best adapted for the boring.

Two other collections of wood were also presented to the society; one from South America, of hard and beautiful varieties, from Francis J. Cisneros; the other from Southern Michigan, by John M. Goodwin.

The usual collation was served after adjournment.

PERSONAL.

J. C. F. CHRISTIAN was lately in Leadville from Ashcroft, where he has been engaged for some weeks past on the Tam O'Shanter.

SIDNEY SMITH, C. E., formerly connected with the engineering department of the Boston Water-Works, has been appointed Engineer of the Tampico (Mexico) Water-Works, recently projected.

CHIEF ENGINEER LUDDEN, of Detroit, had a narrow escape, lately, while crossing the river between the main shore and Belle Isle Park. He, with one of his assistants, was rescued by a ferry steamer.

Mr. J. B. ORMAN, of the firm of ORMAN & CROOK, the railroad contractors, of South Pueblo, was in Denver lately. He left for Bridgeport, where he has four hundred and fifty men at work on the Rio Grande railway tunnel.

GENERAL REVUELTAS, who with a large staff was appointed to survey a Mexican boundary line with Lieutenant SYMONS of the United States Engineers, has been removed by the Mexican Government and a new commissioner and staff appointed whose names are not made public. REVUELTAS stayed behind and left SYMONS to do all the work. This is understood to be the cause of his removal.

MR. WILLIAM F. ALLEN, of Bordentown, N. J., is the originator of the new standard time. Mr. ALLEN's father was a civil engineer and a colonel of a New Jersey regiment during the war. He died in the service. Mr. WILLIAM F. ALLEN began his career as a civil engineer; but from the building of railroads he got to making time-tables, and has been for several years associated with the Official Railway Guide.

CHIEF ENGINEER J. A. LATCHA, of the Nickel Plate, has been elected President of the Michigan & Ohio Railway. Mr. LATCHA was formerly connected with the Pennsylvania company's roads. He has built several of the leading lines in the country, and at the time of his election to the Presidency of the M. & O. he was Chief Engineer of the Rochester & Pittsburgh, Michigan & Ohio, and also connected with the Nickel Plate, as above stated.

DON J. WHITTEMORE, Chief Engineer of the Chicago, Milwaukee & St. Paul Railway system, has been proposed and, following past precedent, will undoubted be elected as the next President of the American Society of Civil Engineers. This action will be especially acceptable to those members of the Society who, upon the occasion of the late Convention, enjoyed the hospitalities of the company of which Mr. WHITTEMORE is the Chief Engineer, and were witnesses to his own able management in the transfer of the members from Chicago to St. Paul, upon what was, to that time, the fastest and best equipped train that ever ran between the two points named.

THEODORE F. RANDOLPH, who died Nov. 7, at his residence in Morristown, N. J., besides being ex-Governor of New Jersey and a U. S. Senator, was in 1867 President of the Morris & Essex R. R. He was credited with doing much to bring about the lease of the Morris & Essex road to the Delaware, Lackwanna and Western Company in order to open up a new trunk line to the West, and facilitate the transportation of coal to New York. As Governor of the State of New Jersey, he secured a repeal of the "Camden & Amboy monopoly tax," and established a general railroad law; Governor RANDOLPH also succeeded in adjusting a quarrel between the Erie and Delaware railroads of thirty years' standing. He was a man of very considerable mechancial ability, and among other valuable inventions perfected a ditching machine for which medals were awarded at the Philadelphia and Paris Expositions.

GENERAL RANOLD S. MACKENZIE who has just succeeded Gen. AUGUR in command of the Department of Texas, is a native of New York, but was appointed at large a cadet at the Military Academy July 1, 1858, and graduated June 17, 1862, at which time he was made a second lieutenant of the corps of engineers. He was assistant engineer of the Ninth army corps; was in the northern Virginia campaign; engaged in the action of Kelly's Ford, Aug. 20, 1862, and the battle of Manassas, Aug. 29, where he was wounded. He was breveted first lieutenant Aug. 29 for gallant and meritorious services at the battle of Manassas, and was absent on sick leave until Oct. 19, when he was attached to a battalion of engineers for a month; was in the Maryland campaign, being engaged in constructing, repairing, and guarding bridges; was in the Rappahannock campaign from December 1862, to June, 1863, being engaged in the battle of Fredericksburg, Dec. 13, 1862, as engineer of Gen. SUMNER'S division. On March 3, 1863, he was made first lieutenant of the corps of engineers. He was at the battle of Chancellorsville, May 2 to 4, and May 3 was breveted captain for gallant and meritorious services in that battle. In June and July, 1863, he was in command of an engineer company, engaged in laying bridges over the Occoquan and across the Potomac at Edwards' Ferry, and was engaged in the battle of Gettysburg July 1 to 3, being breveted major for gallant services in that battle July 4. He constructed the bridges over the Potomac at Berlin, Md., over the Rappahannock in August, and over Bull Run and the Rapidan thereafter. On Nov. 6, 1863, he was made captain of the corps of engineers. From August, 1863, to

May 1, 1864, he was engaged in making roads and reconnaisances, building block-houses and erecting defensive works, and was in the Richmond campaign in command of an engineer company from May 4 to June 10, in constructing defensive works. In May he was in the battle of the Wilderness, the combat at Todd's Tavern, and the battles about Spottsylvania, and commanded a regiment in the Richmond campaign from June 10 to 22, being engaged in the Petersburg siege.

He engaged in many of the Union battles, and from 1867 till now has been engaged in fighting the Indians.

RUNNING CARS WITH CABLES.

We are indebted to the *Tribune* for the follow-data relating to the San Francisco Cable System, and its imitators:

The first concession for a cable road in San Francisco was granted to General Abner Doubleday and Captain R. L. Ogden, of the Army, the originators of the enterprise. General Doubleday's duties taking him from California, all the rights and privileges granted him were sold and transferred to A. S. Hallidie, representing the present Clay Street Railroad Company.

In August, 1873, the Clay Street Hill Railroad Company in San Francisco began business, and since it has been constantly running, and has been found to answer all requirements, and to exceed the expectations of engineers and others who had examined the plans previous to the construction of the road.

The system, as first introduced in San Francisco, is the now generally familiar one of an endless wire rope, running in a subway beneath the track, with a continuous slot or opening in the top of this subway, and midway between the rails. Motion is given to the cars by a thin bar connected at the top with the car, and passing through the slot to the constantly moving cable beneath; appliances technically called the "Grip" permit the conductor at will to grasp the cable and consequently move with it, or let go, and, by brake-power, come to a stand-still at any point. The "grip-car" can pull other cars if so desired.

A description of the Clay Street Road will perhaps give a clearer idea of the system. This street, near the lower terminus of the road, is densely populated. The lower terminus of the road is at the intersection of Kearney and Clay streets. The summit of the hill is 307 feet above Kearney st. The incline inClay street has a double track and is 5,197 feet long. The rope runs into the engine house at Leavenworth-street. The steepest ascending grade is 1 in 6 15-100. An endless steel wire rope, three inches in circumference and 11,000 feet long, is stretched the whole distance, lying in iron tubes, supported every 39 feet on 11-inch sheaves. This rope is supported at every change of angle at the lower crossing on sheaves four feet in diameter, passing around a horizontal sheaf eight feet in diameter at the lower end of the line, and at the engine house around two angle sheaves, each eight feet indiameter. which are driven by one 14x28 engine, the steam being furnished by a boiler 16x54 inches in size, using 3,700 pounds of coal per day. They have a duplicate engine and boiler also, which are held in reserve.

The grip pulleys being furnished at their circumference with jaws that grip and release the rope automatically by the pressure of the rope in the jaws, prevent it from slipping, and being set in motion by the engine actuates the endless rope while traveling up one tube and down the other.

In addition to the sheaves that support the rope in the tubes, at the upper side of each crossing where the incline makes an angle upward there are sheaves in the tubes that keep the rope from striking the upper part of the tube.

There is an opening in the upper side of the tube. This opening runs the entire length of each tube, forming a long slot three-fourths of an inch wide. This slot is not immediately over the centre of the tube but one side, to keep sand and dirt from falling on the rope and enable the foot of the gripping attachment to pass by and under the upper sheaves and over the lower sheaves in the tube.

The cars seat fourteen passengers and the dummy sixteen, but frequently as many as forty-four have ridden in the car and twenty-six on the dummy. On the roads with the broader gauge and larger cars as many as 160 passengers have been carried. The passenger car is amply provided with brakes sufficiently powerful to stop the car on the steepest grade. Strong drags also trail behind, which take the ground on any backward motion of the car. The dummy is also provided with powerful brakes. On descending the weight of both cars comes on the rope, which, of course, assists in dragging the upward cars on the hill; thus the descending and ascending cars travel at the same rate of speed. The gripping attachment used is simple; a vertical slide works in a standard and is moved up and down by a screw and hand wheel, the small upper screw going down through the large screw and operating it. At the lower end of this slide is a wedge-shaped block. The wedge moves two jaws horizontally which open and close according to the direction in which the slide is moved, closing when the slide is moved upward. The jaws have pieces of soft cast-iron, are of proper shape and size inside to grip the rope when they are closed over it. On both sides of these jaws, and attached to them, are two small sheaves. These sheaves are held by means of rubber cushions sufficiently in advance of the jaws to keep the rope off the jaws and at the same time to lead the rope fairly between them, allowing it to travel freely between the jaws when they are separated without touching them. When it is required to grip the rope this slide is drawn up by means of the small screw before described, and the wedge at the lower end closes the jaws over the rope, simultaneously forcing back the small guide sheaves into the rubber springs. The standard containing the slide is inclosed and retained in an iron bracket, and is raised and lowered through an opening in the tube from above the surface of the street to the rope by means of a screw and nut with hand-wheel attached. The iron bracket is secured to the dummy. The dummy is coupled to the car at the bottom of the incline and uncoupled at the top. In order to stop the car, the jaws of the gripping attachment are opened slightly. When they release the rope the guide sheaves take it and the car stops. All the essential parts of the gripping attachment are made of steel.

The rope runs 17½ hours each day at a speed of six miles per hour. The cars start every five minutes, except in the afternoon, when they start at intervals of three minutes. The stretching arrangement at the lower end keeps a constant strain on the rope under all circumstances.

After the Clay street road had been running three years, and its practicability had been fully tested, the Sutter Street Railway Company changed its system from a horse road to a cable road. This company has now over three miles of double tracks operated on this system. The greatest elevation is 167 ft. above its starting point. The saving in expenses, as stated under oath in testimony given in a suit affecting the company, amounted to 30 per cent, and the passenger traffic was increased $962,375 the first year after adopting the cable system. The shares of the company were selling before the transfer at $24. They are now worth $60.

The next road built on the cable principle was the California st. road, which traverses the steepest street in San Francisco, the grade being 500 ft. in 12,000. The next street supplied with the cable system was Geary st., a comparatively level thoroughfare, but one of the most populous in the city. Its length is 13,200 ft. and it possesses two elevations of 350 and 280 ft. respectively. The Presidio and Ferries Cable Road has a 5-ft. gauge, and 10,000 ft. of double track ascending one hill 246 ft. above its starting point in a distance of 5,000 ft., one portion being an up-grade of 78 ft. in 412 or 1 in 5 1/10. The grip is the same used on Clay st. but made heavier. A road has been built under these patents in the City of Dunedin, New-Zealand, 3,500 ft. long, which ascends 500 ft. in that distance. It has a single track line, with two turnouts or sidings, both parts of the rope-running in opposite directions in one tube except at turnouts. It has two curves of 215 ft. radius forming an 8.

The Chicago City Railroad Company's cable line in State street is 4 7/10 miles long, with double tracks, 5-ft. gauge, and runs on a very busy street, almost level. The president of the road says in reply to the question how the system worked last winter during cold weather and snows: "We have run smoothly and without the loss of a single trip during the entire winter, although the frost by actual measurement penetrated the ground 5 ft. 6 in., with heavy snow and hard rains, the mercury dropping to 29° below zero."

To build and equip with cars, dummies, engines, wire and everything needed to put the road in complete working order will cost, under the Hallidie system, for a distance of, say, three miles, at the rate of $80,000 per mile—double track. The average running expenses of a horse railroad with double track, at a speed of 4½ miles per hour, 32 cars, headway 2½ minutes, exclusive of administration, are $138,880 per annum. The actual running expenses of a cable railroad of three miles, 24 cars and 24 dummies, leaving every 2½ minutes, including 6 per cent. interest on plant, are $88,246.71, showing a saving of $50,633 per annum in favor of the cable, or 36 46/100 per cent., with greatly increased carrying capacity.

The cost and equipment of the horse railroads af the city of New York, up to the end of the year 1881, was $22,988,919; the number of passengers carried 154,300,970; total number of miles 121; number of horses required, 11,886; dividends, $1,568,696. The city of Brooklyn has 139 miles of street railroad and requires 5,567 horses. The cost of the plant was $11,736,448 and the dividends paid $501,594.

On the basis of the financial condition, earnings and expenses of all the surface roads in New York aggregated for 1881, the net earnings of the cable roads would have been $3,317,987, estimating the expenses for operating at 35 per cent. of those of horse railroads. The cost per capita, exclusive of interest, would be: Horse railroads 3 61/100 cents; cable roads, 1 46/100; saving per capita in favor of cable road 2 15/100 cent.

No heavy investments in real estate for stables are necessary for cable roads. A site for the engine and machinery is all that is necessary, say 100 ft. square. The investments of the city railroads in almost any large city in horses, harness, real estate, etc., would if sold probably pay the cost of converting horse into cable roads.

In commenting upon the Brooklyn Bridge cable road, the *Tribune* says the great mistake made was in adopting heavy cars with double trucks, weighing ten tons each. The experience of the investigators of the Pacific coast taught them that the lightest car possible was the best. The cable also is said to be heavier than is necessary, and will wear out sooner than a lighter one. Fault is found because the Brooklyn Bridge management did not simply copy the successful practice of other cable systems.

NEWS OF THE WEEK.

FALLING OF THE WISCONSIN STATE-HOUSE—LOSS OF LIFE.—The entire south wall of the Capitol building fell at two p. m. on November 8. The mortar was too fresh, and the contractor made undue haste. The work was only commenced last June, the contract price being $188,000. The contractors are John Bentley & Co., of Milwaukee. Four masons were taken out dead from the ruins, but twenty others are severely, and many of them fatally injured. The girders and wall braces were also said to have been insufficient. Mr. Jones, of Madison, was the architect, and H. C. Koch & Co., of Milwaukee, consulting architects.

MADISON, Wis., Nov. 6.—The Penokee & Gogebic Railway Company filed articles of association at the State-House, the object of the association being the construction of a railroad from some point on the main line of the Wisconsin Central Railway in Ashland County to some point in the same county on the Montreal River, a distance of sixty miles, more or less. The capital stock is $2,000,000, divided into 20,000 shares, and the directors for the first year are: J. L. Colby, Howard Morris, T. L. Kennan, Gavin Campbell and Fred Abbott, all of Milwaukee.

RAILROAD CONTRACT.—A contract has been signed by J. J. McMullin & Co. to construct for the San Francisco & Colorado River Railroad a ferry landing and depot at Alameda Point within 120 days. The contractors have sub-let the contract to various firms.

THE AREA OF CALIFORNIA.—The United States Coast and Geodetic Survey Department in San Francisco, under Professor George Davidson, has completed the survey of California islands and State shores, and has cheerfully and attentively given as nearly as possible the exact areas of said islands. The first sent was merely the sum total of their areas; but on a personal request for the particulars, he gave the high-land area of every island separately. This information will be especially interesting—as it is almost exactly to a quarter of a mile—to all Californians south of Point Conception, where all the islands are situated. It is as follows:

Name.	Square miles.	Name.	Square miles.
San Miguel	14	Santa Catalina	72
Santa Rosa	81	Santa Barbara	1
Santa Cruz	94	San Nicolas	22
Anacpa	1½	San Clemente	54

Making in all 339 square miles to add to our 158,000.

A LARGE BUILDING CONTRACT.—Dr. H. M. Caldwell, of the Elyton Land Company, has a contract for building the machine, car and repair shops of the Cincinnati, New Orleans & Texas Railroad.

MESSRS. ROGERS & BALLENTINE have obtained contracts to build bridges and lay track for a distance of 33 miles above Baton Rouge, on the Mississippi Valley road.

THE MINNEAPOLIS WATER-WORKS.—Among the recent great improvements are: The tunnel, which serves as an outlet for the new extension, 400 ft. in length, and constructed at a cost of $17,000. The new intake pipe—which will soon give the city purer water than ever before—is 702 ft. in length, and involves an expenditure of $16,800.

THE NEW CLEVELAND BRIDGE.—The board, by a unanimous vote, decided to select the Davis street and Broadway extension route for the building of the Kingsbury Run bridge. The estimate cost, including right of way, is $235,000.

SURVEYORS were at work last week running a line from Belvidere across Northampton County to East Bangor, in the interest of the Pennsylvania Railroad, which will run a branch to Bangor and Penargyl if the route shall be found more practicable than the one by Martin's Creek. Another

surveying party has also been at work near East Bangor in the employ of the Philadelphia and Reading Railroad.

THE CLEVIS BRIDGE.—The County Engineers of Cincinnati have been directed to prepare the plans and specifications for an iron bridge with railing, and the masonry to be made of the best Indian flat rock stone.

THE CLEVELAND HIGH SERVICE RESERVOIR.—At a special meeting of the Board of Water-works Trustees, held Oct. 30, the bids for building the high service reservoir were opened and the contract awarded. The specifications call for 158 cu. yds. of earth excavation, 21,300 cu. yds. of clay puddle, 5,300 yds. of broken stone, 550 cu. yds. of gravel, 6,600 cu. yds. of concrete, 12,000 sq. yds. of stone paving, sixty stone steps, two inlet and outlet channels, and 17,500 sq. yds. of soiling and seeding. The cost, as estimated by Engineer Whitelaw, is $120,291.

The following bids were read:

Freeman & Hall	$120,651
Edward Cowley, Jr., and James H. Cowley	120,814
Luke Brennan and Frank Rieley	121,067
William McReynolds, John Gawne, John T. Gawne, and W. J. Gawne	126,430
H. M. Claflen	137,585
Allen R. Jewett, Charles H. Watkins, and H. C. Herron	160,035
James Harris and John T. Gill	162,230

Freeman & Hall being the lowest bidders, they were awarded the contract.

THE NEW YORK AQUEDUCT.—Mr. Charles Schampain, as the representative of the Taxpayers' Central Association, has filed with the Aqueduct Commission a memorial opposing the Hudson River route, and favoring the Bronx River scheme and the proposed Saw-mill Valley line.

THE contractor of the Columbus and Eastern Road, Mr. S. G. Roser, states that only twelve miles remain to be built.

STONEWALL JACKSON'S BRIDGE BUILDER.—A useful man to Stonewall Jackson was old Miles, the Virginia bridge-builder. The bridges were swept away so often by floods, or burned by the enemy, that Miles was as necessary to the Confederate army as Jackson himself. One day the Union troops had retreated, and burned a bridge across the Shenandoah. Jackson, determined to follow them, summoned Miles.

"You must put all your men on that bridge," said he; "they must work all night, and the bridge must be completed by daylight. My engineer shall furnish you with the plan, and you can go right ahead."

Early the next morning Jackson, in a very doubtful frame of mind, met the old bridge-builder.

"Well," said the general, "did the engineer give you the plan for the bridge?"

"General," returned Miles slowly, "the bridge is done. I don't know whether the picter is or not."

NEW HAVEN (CONN.) HARBOR IMPROVEMENT.—The report of the Chief Engineer to the incoming Congress states that the present contracts for work on the dike in New Haven harbor covers the shore connection, which includes all the rip-rap work and about 850 ft. of pile work, also about 250 ft. of the channel dike. This will cost about $70,000 at the present rate. The dike, dredgings and the breakwater project will cost $1,311,134, according to estimate.

THE LORDSBURG AND CLIFTON.—Work is now resumed, and only five miles remain to be laid. In this distance three bridges are to be built.

THE UTAH & NORTHERN are at the head of the Madison River surveying a route to the geysers. The road will join the Canadian Pacific.

NEW LIGHT AND HEAT COMPANIES INCORPORATED.—Union Light and Heat Company of Westmoreland county, with office at Pittsburgh, capital stock $1,000,000; O'Hara Light and Heat Company, of Pittsburgh, capital $5,000; Derry Light and Heat Company, of Westmoreland county, capital $5,000; South Light and Heat Company, of Pittsburgh, capital $5,000; Harman Light and Heat Company, of Pittsburgh, capital $5,000; Pennsylvania Light and Heat Company, of Pittsburgh, capital $5,000; Loyalhanna Light and Heat Company, of Westmoreland county, capital $5,000; North Light and Heat Company, of Pittsburgh, capital $5,000; Bell Township Light and Heat Company, of Westmoreland county, capital $5,000; Plum Light and Heat Company, of Allegheny county, capital $5,000.

HIGH explosives, when properly packed and loaded will be taken by the Union Pacific without extra risk.

LEADVILLE'S RICHES.—The total production of Leadville, in the various metals, up to the present time, is about as follows: Tons of lead, 179,000; ounces of silver, 35,250,000; ounces of gold, 50,000; tons of ore shipped to smelters outside of Leadville for treatment, 290,000. The total value of the product of the district up to the present time exceeds $80,000,000.

The profits derived from working the Leadville mines are extraordinary compared with most districts, as attested by the numerous dividends paid by the incorporated mining companies, as well as the large incomes of individuals. Among the companies that paid dividends in the last 30 days are the following: Iron Silver, $100,000; Silver Cord, $45,000; Morning Star, $25,000; Evening Star, $25,000; Leadville Consolidated, $20,000; Dunkin, 10,000; Amie, 10,000; Little Chief, $10,000.

Civil Engineer Yates, with a party of ten, has been engaged surveying the line for the proposed railroad from Fort Plain, by the way of Richfield Springs, Cooperstown, N. Y.

A MONSTER ENGINE.—R. O. Carseadin, master mechanic of the South Western division of the Rock Island road, gives some interesting details of the mammoth locomotive in progress of construction at the Central Pacific shops at Sacramento. He says: "The name is 'El Gobernador' The total length of the engine and tender is 65 ft. and 5 in.; driving-wheel base, 19 ft. and 7 in.; five pair of drivers, 4 ft. 9 in. in diameter, with a four wheel truck in front; cylinders, 21 in. in diameter, with a 36-in. stroke; total weight of engine 73 tons; weight on drivers, 64 tons; weight of tender (light), 50,650 pounds. There are two six-wheel trucks under the tender, making a total of twenty-six wheels under the engine and tender. The valve gearing, designed by A. J. Stevens, is something entirely new, there being nothing like it in this country. It is said to be the largest engine in the world."

REBUILDING THE TEMPLE.—A gentleman named Durgin, belonging in York, Me., a stone mason, left Portsmouth, N. H., to join a party of twelve other men bound for the City of Jerusalem. The party goes to help rebuild the Temple.

RICHARDS & DANBY are building the Northern Pacific from Superior to Ashland.

GEORGETOWN (TEX.) WATER-WORKS.—There is to be a vote of the people on the contract entered into with the water company.

THE Columbus (TEX.) water-works will be opened in a few weeks.

PROPOSED BRIDGE AT READING.—READING, Pa., Nov. 5.—Cyrus G. Derr and others, representing the Pennsylvania Railroad Company, called upon the County Commisssoners this a. m., and proposed to contribute $20,000 toward the construction of a new iron bridge across the Schuylkill River at foot of Penn street, or that the railroad company would accept $20,000 from the county and build a bridge equal to that at Bingaman street, at a cost of about $40,000.

BRIDGE CONTRACTS.—W. C. Irwin, superintendent of bridges on the Bee-line system, was lately in Indianapolis. He has given out contracts for first-class iron bridges on the Indianapolis & St. Louis road: At Fern, the structure to be 275 ft. long, in two spans. At Embar's, one 300 ft. long, in two spans, and a one-span bridge at Hillsboro 120 ft. long, and work was begun last week on a new bridge at Avon, two spans, 100 ft. each in length.

THE Kansas City Belt Road has been begun.

RAPID TRANSIT IN CINCINNATI.—A meeting of Walnut Hills residents was held last week to confer with owners of route No. 10 of the Cin. & Walnut Hills R. R. Co., but no resolution was taken.

AN extension from Washington (Pa.) to Connellsville is spoken of. Proposals for building the line are invited by the Baltimore & Ohio. The route is about 40 miles in length.

THE MEMPHIS, VICKSBURG & NEW ORLEANS.—Col. Grover, chief engineer of the division lying between Memphis and Clarksdale, Miss., states that rapid progress is being made. The contract for the bridge over the Sunflower, a superstructure of three spans of 125, 150 and 125 feet each, has been let to George Arnold & Co., of Memphis, under whom the entire work thus far has been done. There are now about 1,000 men engaged, distributed as follows: Track-laying, 100 men; bridges and trestles, 150; on the grade at Hull's break, 160; on the grade between Clarksdale and Hosppackony, 350; getting out ties, 100.

RAILROAD BUILDING IN TURKEY.—The Sultan has lately sent to the consuls in this country a pamphlet showing the steps to be taken to obtain railroad concessions.

WHAT HAS BECOME OF NEW YORK'S WATER?—The following letter appears in the New York *Times:* "Will the 'Surveyor' continue to explain about the streams and swamps in this city formerly, and inform us where the large body of water originated covering Fifth avenue from the Windsor north, and on Madison avenue to Lenox Hill, where people bathed and sailed boats? By the way, he does not mention that Madison Square 40 years since was the House of Refuge, with high stone walls around the square, and that the old willows now standing diagonally to Fifth avenue were in the same position to that building, before destruction in its courtyard. The potters' field was built up after the yellow fever of 1823, and north one block was "Sun-fish" pond, of an acre, from 1 to 8 feet deep, extending in a swamp to Sixth avenue. An old wooden building on Ninth street, one door east of the avenue, was there at the time —1830—but raised one story. It now stands on the south side. One block east of St. Mark's Church, that is now Second avenue, was Cedar Creek, covering two or three squares and deep. How about the streams up to Murray Hill on Fifth avenue? H. G. SCHUYLER."

"Nov. 6, 1883.

NEW ROAD.—The project for building a road from Tell City and Cannelton via Leavenworth to New Albany, is taking definite shape.

THE CHICAGO & SOUTHERN.—F. H. Peters, Chief Engineer of this road, reports that 80 miles of way will soon be completed. The company will push on to Rockville, Ind. The line has been surveyed, and during the present winter the plans and specifications will be prepared and the contracts for construction let. After reaching Rockville, Brazil will be the next point made.

THE Terre Haute & Southwestern project has been given up for the present.

THE WHEELING BRIDGE.—The Committee of Pittsburghers who went to the Government Engineer's office in New York have returned. Their mission was satisfactory. The new bridge will be located above the head of Wheeling Island, and will be ninety feet above low-water mark, with continuous spans. The main channel span will be 507 ft., the others 250 ft.

THE CATSKILL WATER-WORKS.—Ground having been broken for the new water-works, the contractor, Shanley, will push the work along as rapidly as possible.

THE ELEVENTH MISSOURI BRIDGE.—This bridge between Blair and Missouri Valley was formally opened last week. Among the engineers present were: J. G. Johnson, E. F. Farnham, D. E. Johnson. The bridge is a structure of three spans, each 333 feet in length, and is of iron. The bridge, which cost about $1,000,000, has been built by and is the property of the Missouri Valley and Blair Railway Bridge Company, a corporation organized especially for the construction of this bridge. The iron and steel work was fabricated and erected by the Keystone Bridge Company, of Pittsburgh, Pa., from detailed plans prepared by the engineer of the Missouri Valley and Blair Railway and Bridge Company.

The staff of engineers and the principal contractors for this work have been as follows: Chief Engineer, Geo. S. Morison. Resident Assistants—First assistant engineer, H. W. Parkhurst; assistant engineer, Emil Gerber. Non-resident assistants—Assistant of superstructure, C. C. Schneider; inspectors, W. F. Zimmermann, G. C. Henning; contractors of masonry, T. Saulpaugh & Co.; contractor for superstructure, Keystone Bridge company, of Pittsburgh. W. Baird, superintendent of erection.

SERIOUS WATER FAMINE IN WATERBURY.—WATERBURY, Conn., Nov. 7.—The water famine here is assuming alarming proportions. The recent rains have not raised the reservoirs, but have, on the contrary, begotten such prodigality among consumers of water that the reservoirs are lower than before. An order was issued to-night prohibiting the use of water in private families except for positive necessities, cutting off stables and the like, and finally forbidding its use in the many factories save by special permit. As a result the people have attempted to resort to wells, and this has caused an epidemic of typhoid. The outlook for the winter is indeed pitiful. Waterbury belies its name, and its great industries as well as its health were never so seriously threatened.

LARGE CONTRACT FOR STEEL RAILS.—PITTSBURGH, Nov. 7.—The announcement that the Lackawanna Iron Mills had taken a contract for 30,000 tons of steel rails at $35 per ton occasioned considerable talk among those interested in that industry here. Thomas M. Carnegie of the Edgar Thomson and Pittsburgh Bessemer Mills, in an interview, said they could not manufacture rails at that price, and as the orders on hand would not keep the mills running longer than Jan. 1, they would probably be compelled to shut down. By the stopping of the mills at Homestead and Braddock nearly 5,000 men would be thrown out of employment, and the coke trade interfered with.

THE ST JOHN RIVER BRIDGE.—Since the company was organized to build the railroad bridge across the river at St. John, N. B., the work of connecting the two railway systems of the Province has been rapidly pushed along. The pier for the bridge on the north side of the falls is rapidly rising. The grading and bridge work will be continued through the winter, but the masonry work on the piers at the falls will be suspended as soon as frosty weather sets in, to be resumed early in the spring, when 300 men will be employed to push the work along, that it may be completed by the specified time, August 15.

THE LOW PRICE OF STEEL RAILS.—PITTSBURGH, Penn., Nov. 7.—Thomas Carnegie, of the Bessemer and Homestead Steel Rail Mills, says that if steel rail manufacturers continue reducing the price of

rails he will have to close his works and throw 5,000 men out of employment. He said that he would try to meet the cut of the Lackawanna Mill to $35 per ton, but could not tell how long he would run on that basis. It would probably be but a very short time. Referring to the rivalry between rail manufacturers, a steel-worker said this evening: "The talk of depression means that the employers want wages reduced. It is now approaching the time when the workers in the steel rail mills must make their yearly contracts with the employers. From present indications it looks as if wages would have to come down." The stoppage of the Carnegie Works would seriously affect the coke trade and almost ruin the towns of Braddock and Homestead. The Western Rail Association failed to meet to-day. This means that trade is satisfactory and the mills will continue in operation.

There is a probability of a conference between the glass manufacturers and the strikers to agree upon the scale of wages.

THE Massachusetts Railroad Commission. The Board lately visited the location of the Cape Cod Canal. City Engineer Evans of Lowell accompanied the Board.

MINNEAPOLIS WATER-WORKS.—The new 10 million gallon pump, designed by Mr. James Waters, was started on the 27th ult. The pump cost $9,500, and is described in the columns of the Minnesota *Tribune* as follows:

"The pump receives its power from a 60-inch water-wheel of 500 horse-power, to which is attached an upright shaft 6¼ in. in diameter. The pump rests directly over the water-wheel, the shaft making connection with it in the center of the machinery.

It consists of five iron columns 37 in. in diameter and 11 ft. in height, the top of each being in the form of a dome. The columns are placed in a circle. Each column is divided into three chambers —a lower, a central, and upper chamber. Within the space circumscribed by the circle of columns, are two circular pipes placed horizontally, one above the other. The size of these pipes is 20 in., and they are connected with the columns by connecting pipes as follows:

The lower one, with each of the lower chambers, and also with the suction pipe, and the upper with each of the upper chambers and with the discharge pipe. (To more clearly locate these two pipes it may be added that they are respectively on the same plane, horizontally, with the upper and lower chambers of the columns.)

The movable part of the machinery connects with the stationary parts as follows: The plungers and connecting rods play horizontally between the central chambers of the columns (the plungers entering the chambers) and a crank on the upper end of the water wheel shaft—the said end being exactly midway between the two circular pipes and coinciding with a line drawn perpendicularly through the centers of both the circles formed by the circular pipes. Each connecting rod (whose outer end is attached to its plunger) is connected in the center to a crank-eye on the shaft-crank and oscillates on a pinion as the crank revolves. The crank-eye is also fastened rigidly to an extra connecting rod and plunger—called the "Idler"—the latter doing no service except to keep the "eye" in position as the crank revolves.

Now, when the shaft and crank are put in motion the plungers—each in turn—are forced in and out of the central chambers by the connecting rods. As the plungers are drawn out, the water is sucked through the suction-pipe into the lower circular pipe and thence into the lower chambers, passing upward through valves, just under the plungers, enters the central chambers. As the plungers are forced back into the central chambers, the valves below close, and the water is forced into the upper chambers—the domes of which act as air-chambers—thence into the upper circular-pipe and finally into the discharge pipe.

At every revolution of the shaft all of the five plungers performs this service, and in an instant 75 gallons of water pass through the pump; with 100 revolutions 7,500 gallons pass through, which occupies one minute of time at full speed. The ordinary pressure communicated to the mains by this pump is 50 pounds, the gates being about a quarter open. During a fire or other emergency the pressure can be doubled. At ordinary times this pump will furnish the entire supply for the mains as they are now. It can be supplemented, however, by the other pumps, which have a combined capacity of 13,000,000 gallons per day, giving an aggregate of 23,000,000 gallons, which will be sufficient for some time to come.

THE MEMPHIS CANAL.—CHICAGO, Nov. 1.—The Hennepin Canal was discussed by a large meeting. It was decided to reorganize the Mississippi River Improvement incorporation. The title was changed to the Michigan and Mississippi Canal Commission. Three routes were proposed, the first being the Marais-d'Osier route, length 64 miles; the Watertown route, length 65 miles and the Rock Island route, length 75 miles. Resolutions were passed declaring that the construction of the Mississippi and Illinois Canal and the enlargement of the Illinois and Michigan Canal should be undertaken by the national Government. Among the new members elected were Mayor Edson, A. B. Miller, F. B. Thurber, and Gustav Schwab, of New York; John S. Swits, James I. Martelle, and Robert C. Darne, of Schenectady; J. McArthur, of Troy, and A. B. Richmond, of Buffalo.

THE NEW RAILROAD TIME.—President Watrous, of the New York, New-Haven & Hartford Railroad, has issued an order to the effect that on and after noon of Sunday, Nov. 18, the time used upon that road will be of the seventy-fifth meridian of west longitude, which is about four minutes slower than New York city time.

ECONOMY ON THE NORTHERN PACIFIC.—Vice-President Thos. F. Oakes is on a tour to cut down expenses. The total operating expenses last year were $4,953,066.82, or 63 per cent. of the earnings. Col. Oakes believes that the road can be operated for 50 per cent., and if the earnings amount to $15,000,000, the reduction will amount to something.

THE ST. LOUIS STREETS.—Michigan avenue (Chicago) is exciting the envy of St. Louis. Gen. Turner of St. Louis says:

"Give me the same conditions here and I'll give a boulevard equal to Michigan avenue. The cost of paving that avenue was an average of $16 per front foot. I have received reports from the London Metropolitan Board which show that the average cost of maintaining macadam streets is from $5 to $5.30 per square. Now we have in St. Louis about 312 miles of streets, and of these about 250 miles which require to be kept in first-class repair. The average number of squares to a mile of sixty-foot street is about 1,900. Multiplying 1,900 squares by 250 miles we have 475,000 squares, to be macadamized and kept in repair. Multiplying by the cost per square, that is $5.30, we have $2,612,500.

THE Canton and Waynesburg Railroad & Mining Co. has been organized to build a narrow gauge between the two mentioned places.

NEW LINE IN WISCONSIN.—LA CROSSE, Wis., Oct. 30.—A party of surveyors have been at work for some days in the western part of this State laying out a line for a new railroad from East Dubuque along the east side of the Mississippi River northward, and the ultimate destination is evidently the cities of St. Paul and Minneapolis. The ostensible name is the Winona, Alma & Northern Railroad, and it is thought that the Illinois Central is the power behind.

THE FARGO (D. T.) SOUTHERN.—Arrangements have been made for constructing this road independent of the Manitoba road.

FITCHBURG (Mass.) WATER-WORKS.—City Treasurer Willis has negotiated city bonds to the amount of $40,000 for paying for the extension of the water works. The bonds are at 4 per cent. interest, payable at the option of the city in ten years from October 1, 1883, and redeemable twenty years from that date. The bonds are taken by Blake Brothers & Co., of Boston, at 101¼, and it is understood that they go to two Massachusetts savings banks.

ANOTHER TUNNEL SCHEME.—A tunnel is being advocated between Portsmouth and the Isle of Wight (England).

THEY ARE NOT SURVEYORS YET!—The Boston *Journal* says: "Inquirer.—No you are in error. The procession of young men who are to be seen coming out of the Institute of Technology on pleasant afternoons, bearing long red-and-white striped sticks upon their shoulders, are setting forth for the practical study of land surveying. Your supposition that they were the class in easy shaving, although reasonable enough, is erroneous."

JEFFERSON (Ill.) is badly in want of water. Lake View would combine to build a system for both towns, but the proportion of cost for Jefferson would be too heavy.

GRADE CROSSINGS.—Several railroad men met this week in Boston to consider the different systems of signals.

THE high water in the Allegheny River has caused a cessation of work on the new Seventh street bridge.

CAR WORKS SOLD.—The sale of the Huntingdon car works was begun last week. The Pennsylvania Railroad Company purchased largely.

THE HELENA, SARDIS & BIRMINGHAM.—There is considerable interest manifested in this road. The distance from Helena to Sardis, on an air line, is 37 miles, to Oxford 58, to the Alabama state line 189, and to Birmingham, Ala., 292 miles.

NEW COURT-HOUSE.—Adrian (Mich.) is receiving architects' plans for a new court-house, not to exceed $50,000.

BOSTON SALARIES.—The Common Council has increased salaries as follows: Assistant Inspector of Buildings from $1,400 to $1,500; Assistant Superintendent of Chelsea Bridge from $600 to $700.

ABILITY TO SUPPORT RAILROADS.—The new Baltimore & Philadelphia Railroad, for which the Garretts have borrowed $12,000,000, and which will cost, it is said, $100,000 a mile at least, is going forward, and at several places from the present line its embankments can be seen, and lines of carts in the fields. These new railroads, I am informed, particularly in Pennsylvania, do not pay for the land at so much an acre, but at an estimated injury to the integrity of the farm and its operations. The farmers are very tenacious about having their land and lanes spoiled. When there is a quarrel the railroad takes the land and throws the matter into the courts, to be subsequently adjudicated. I asked a wealthy man who is a heavy stockholder in many railroads, and also a farmer, if he thought there was not too much railroad competition coming. Said he: "I have expressed the opinion for the last fifteen years that a State as rich, for example, as Iowa, where I lived a good while, could support railroads ten miles apart, and I see reason every day to confirm my judgment. I mean that when the land is settled as thickly as it should be for the character of the soil, that railroads ten miles apart can get all the traffic they want."—"*Gath*" *in New York Tribune.*

MASSACHUSETTS AVENUE, Boston, is to be extended at a cost of $55,000.

ST. LOUIS SALARIES.—At a recent meeting of the City Council the following salaries were fixed: An assistant sewer commissioner, $1,200; a civil engineer in Sewer Department, $1,200; a draughtsman in same department, $1,200.

INSPECTING THE PAN-HANDLE.—The party inspected 627 miles of the main line from Pittsburgh to Columbus and from there to Cincinnati and Chicago. M. J. Becker, Chief Engineer, accompanied the party.

THE NORTHERN PACIFIC shops at Brainerd, Minn., had 460 of its hands discharged recently, although all departments were pressed with work.

THE Cincinnati, Green River & Nashville will doubtless be begun soon. E. E. Zimmermann, of Cincinnati, has been in Nashville making arrangements to that effect.

THE MARYLAND STATE SANITARY CONVENTION.—The sessions of the Sanitary Convention, which meets in Baltimore November 27th and 28th, promise to be of great interest. The subjects selected for discussion and on which papers are solicited are as follows: Ventilation, House Drainage and Sewerage, Distribution and Purification of Water for Domestic Use, Hygiene of Public Establishments, Steamboat and Railway Cars, Contagious and Infectious Diseases, Injuries to Health from Overflowed Lands and from Mill-dams and other Obstructions in Rivers, School-life and Hygiene, Causes of Insanity, Malaria, Vaccination and Vital Statistics, Sale of Poisons, Laws Regulating the Practice of Medicine and Surgery, and any others germane to the public health.

THE great Mullan Tunnel on the Northern Pacific is now laid with track.

THE UTICA (ILL.) BRIDGE.—This bridge over the Illinois River at Utica has been returned to the Wrought Iron Bridge Co., of Canton, O. During the six years that the bridge has been built Deer Park has used it almost exclusively, and yet failed to pay any portion of its cost. The bridge company has had the case in all the courts, and had it argued probably a dozen times. The original claim of the plaintiff was about $20,000.

CHICAGO IMPROVEMENTS.—The Commissioner of Public Works estimates the expense of erecting a bridge at Market street at $150,000.

The Commissioner of Public Works recommends that the $15,000 now in the city treasury for bridge improvements be appropriated to erecting a permanent structure at the west end of the Adams street Bridge.

THE Boston Water Board visited the Mystic water-works again last Tuesday and inspected the workings of the Farquhar filter. The board state that they are satisfied with the new filter, and one larger than that tested, but on the same principle, will probably be placed in position,

THE BRIDGE CONTRACTORS' CONFERENCE.—The bridge contractors and builders met in the Grand Pacific Hotel Chicago, on Friday. Oct 26. Their meeting lasted several days. The principal object was to devise a system of measurements by the use of which parties advertising for bids can give in the advertisement accurately and concisely the dimensions of all parts of the work to be done. This system will be agreed to by all the prominent bridge-builders and will be made known in printed circulars, which will be sent to state and county authorities who have such work in charge. Heretofore it has been impossible for a contractor to make any estimates as to the cost of the work until he had visited the ground and conferred with the parties in charge of the work. With this system in use he can prepare his estimate from the measurements contained in the advertisement.

THE NAHANT SEWERAGE.—The report of the Massachusetts Board of Health, Lunacy and

Charity states that the number of water companies from which reports have been received is seventy-one. Alluding to the Nahant sewerage, the report says: "It is believed that the pipe system at Nahant represents to-day the only thorough system of separate sewers in the country." Every portion of the system can be and is inspected periodically. Every length of pipe can be examined and cleaned, not only by flushing, but by scrubbing with wire brushes. A manhole is placed at every joint and bend in the pipe. Inspection is made by reflecting the sunlight through the sewer from one manhole to another by means of mirrors.

RAILROAD CONSTRUCTION.—Last week's record of railroad construction in this country shows that 24½ miles of track were laid, making the aggregate for the year up to the present time 5,188 miles as against 8,446 for the corresponding period in 1882; 5,763 in 1881, and 4,614 in 1880.

KANSAS CITY IMPROVEMENTS.—Chief Engineer Knight states that there are various plans under consideration for giving better communication between Kansas City and West Kansas. A survey for a boulevard has been made; the cost is placed at $50,000. Another route is estimated at $17,000.

A LONG WIRE ROPE.—A reel of wire rope for the Market Street Railroad, San Francisco, and manufactured in that city, is 22,000 ft. long five in. in circumference and weighs 30 tons.

CHIEF ENGINEER BRIDGES, of the United States Central Railroad, has a power of attorney, signed Richard King, empowering him to assist in the formation of the company.

A CHOICE OF STONE.—The directors of the Western Indiana Railroad are not united as to the stone to be used in the new Polk st. depot. Most are in favor of a light brown sandstone from Newark, N. J. They are opposed to the Bedford stone, not only because it does not blend well with the pressed brick and terra-cotta also to be used in the construction of the depot, but also because it has been demonstrated that the Bedford stone does not wear well in this climate. It is quite certain that the New Jersey sandstone will be selected.

"IRON IS DOWN."—"Twenty-three dollars for that ere stove!" she exclaimed, as she held up her hands in horror.

"Yes'm—twenty-three."

"But iron is down."

"Yes."

"I've seen in the papers during the last month where as many as six big iron companies have failed."

"Well?"

"Well that ought to make stoves cheaper, and I know it."

"Madam, in the last two months death has laid his hand upon as many as twenty-five young 'uns in this town."

"Yes, poor things."

"But are nursing-bottles any cheaper than three months ago?"

"No-o," she slowly admitted.

"Of course not. Madam, the laws of trade are immutable. The best I can do is to throw in a horse-radish grater, if you take the stove at $23."—*Wall Street News.*

TOYAH (TEX.) is agitating for a railroad to Fort Davis. Negotiations are pending with the Gould system for building the road at once.

THE FORT EDWARD BRIDGE DISASTER has been found attributable by a coroner's jury to the unsafe condition of the bridge, and they censured the Engineering Department for negligence, and the Railroad Superintendent for allowing trains to cross at the rate of 15 miles an hour, and the Chief Engineer for permitting the bridge to go without inspection.

BRICK PAVEMENTS.—A gentleman from Bloomington, Ill., stated that he had been instrumental in introducing brick pavement in that city. The pavement consists of two layers, that next to the earth being of soft brick put down flat, and the top layer of hard brick, burnt with anthracite screenings, laid edgewise. The top layer is as hard as granite.

It will last 50 years, is comparatively noiseless and cheaper than wood.

THE CHIEF ENGINEER of the Government railways of Canada denies the reported abandonment of Kicking Horse Pass, on the Canadian Pacific Railway, and the consequent dismissal of 5,000 navvies.

THE NEW MARINE HOSPITAL AT NEW ORLEANS.—The contractor, Mr. J. M. Marshall, of Washington, D. C., is in New Orleans.

NO GEOLOGIST.—There is some sense in astronomy, it means the guidance of the stars in aid of navigation; there is sense in chemistry, it is connected with dyeing and other arts; but "chopping off bits of the rocks," that is a mystery to uneducated persons. A shepherd was sitting in a Highland inn, and he communicated to another his experiences with "one of they mad Englishmen." "There was one," said he, "who gave me his bag to carry, by a short cut, across the hills to his inn, while he took the other road. Eh! it was dreadfully heavy, and when I got out of his sight I determined to see what was in it, for I wondered at the unco' weight of the thing; and, man! it's no use for you to guess what was in that bag, for ye'd ne'er find out. It was stanes." "Stanes!" said his companion opening his eyes, "stanes!" "Ay, just stanes." "Well, that beats all I ever knew or heard of them. And did you carry it?" "Carry it! Man, do ye think I was as mad as hisself? Nae! Nae! I emptied them all out; but I filled the bag again from the cairn near the house, and I gave him good measure for his money."

THE COLUMBUS & CINCINNATI Narrow Gauge is completed with the exception of 13 miles.

THE SURVEY of Pike's Peak (Col.) has been completed. The railroad to be built to the summit will be 30 miles, with a maximum grade of 300 ft. to the mile. Wm. F. Ellis, Jr., is the Chief Engineer.

THE CINCINNATI GREEN RIVER & NASHVILLE.—It is understood that Mr. C. P. Huntington is backing this undertaking, and that it will begin at some point on his line between Richmond and Standford.

A SURVEY of a line of railway from New Canaan to Danbury, Conn., is in progress. The line will pass through Ridgefield Village, Sugar Hollow, to Danbury, uniting with the New England Road near the Fair Grounds.

WINCHESTER (Kan.) wants a standard gauge road from Kansas City to Lincoln, Neb.

PARIS PAVEMENTS.—After numerous experiments with different kinds of pavements in Paris the plan finally adopted is to form a bed of lime concrete for base, and then deposit on the narrow side blocks of pine wood, previously steeped in tar, and of the size of ordinary bricks. Between every row an interstice is left, one-quarter of an inch wide, filled up by gravel and sand, well rammed in, the whole being coated over with another concrete where tar is the binding medium. Experience has tested this plan to be next to perfect.

CAPT. EADS sailed last week for Europe, but he is prepared to undertake the harbor improvements at Galveston, which it is thought will be pressed on the attention of the next Congress.

A LOST RIVER.—Lost River, Idaho, is a hydrographic curiosity. The stream is larger than Wood River, and flows with a good current between solid banks until it reaches the lava plains, where it has heretofore been thought to disappear in the rock. This has, however, been found to be an error, as the course of the stream can be easily traced some twenty miles further, flowing through a cleft in the lava, having changed its course to the northeast, and at last, flowing close to the foothills, sinks in an open sage-brush plain. Some twenty-five miles beyond Arco, which is situated in the lower part of the Lost River valley, is what is known as the Little Lost River. This stream also ends its course by being lost or sunk in the lower plain.

THE GREELEY RELIEF INQUIRY.—Among the officers forming Court are Lieut. Col. O. M. Poe, Corps of Engineers.

CUTTING DOWN TELEGRAPH POLES.—The Sioux Falls (Dak.) City Council had all the telegraph poles in that town cut down on Nov. 3d.

MR. THEODORE. L. DUNN, Chief Engineer of the Hannibal & St Joseph, was lately in Kansas City.

TAMPICO (MEX.) WATER-WORKS.—Contemplated harbor improvements and a railroad now being constructed to San Luis Potosi may make Tampico one of the most important Mexican ports. Public-spirited citizens have joined capital to introduce a sufficient supply of water. The Engineer is Sidney Smith, C. E., formerly of the Boston Water-Works.

IRON, METAL AND COAL MARKETS.

PHILADELPHIA, Nov. 9.

The volume of business transacted in iron and steel in Eastern Pennsylvania during the past week shows some improvement as compared with previous weeks, but there is no improvement in prices, and no immediate prospect of any. There has been quite an active demand for pig-irons of the poorer qualities, and most of this kind of stock has been cleared off, leaving the market in better condition. The prices paid for this iron have been low, but the standard and special brands which are now offered, rebeld with considerable firmness. To-day's quotations are: $20.50@$21 for No. 1 Foundry; $19@$19.50 for No. 2, and $18.50@$19 for mill irons, the latter being the strongest of the three. There are inquiries in the market for about 150,000 tons of steel rails, and some large transactions will probably take place within a week or two, if buyers or sellers will yield a little; in some cases, only 25c. or 50c. stands in the way of business. Makers have been holding to $37 as the lowest price for winter deliveries, but an Eastern company has just accepted a contract for about 30,000 tons of rails at $35, and this will probably cause a further weakening in quotations. Small lots are selling as usual at $37@$37.50. Spiegeleisen and Bessemer are wanted, but no sales are reported, sellers' offers being 50c. below asking prices. Muck bars are selling slowly at $33.50@$34. Some large ship-building contracts have just been closed, and about 3,000 tons of plate iron will be required to fill them; this is having a good effect upon finished iron. Bar is still weak, and sells in retail lots at 2@2.15c.; Plate is quoted at 2.35@2.40c.; structural iron is dull and mills are not very well supplied with orders, but there are large bridge-building requirements in sight, and mills will probably be well employed through the winter. Quotations are 2.40c. for Angles, 2.75@3c. for Tees, and 3.50c. for Beams and Channels, with concessions on large orders. There have been several good sales of old T-Rails at $23.50; bridge rails are quoted at $24@$24.50; $25.50 is asked for double-heads, but the highest offers are made at $25, and this will probably be accepted. Scrap is in moderate demand at $18@$20 for No. 2, and $24@$25 for best selected.

The trade in manufactured iron continues dull and quiet, and prices are unchanged at 2@2.10c. with concessions for the sake of securing good orders; mills are moderately busy, but no large orders can be placed, and it is probable that the winter trade will be dull. Structural iron is unchanged and the market is weak: Quotations are given as follows: Tank, 2.70@2.80c.; Angles, 2.80@3c.; Beams, 2.60 in large lots; Channels, 3.80; Flange and Shell unchanged. Some good orders for galvanized iron are reported, but prices are very low; Juniata is 45 and 5 off, and refined 45 and 10 off. Black sheets are firm, but the demand is light. The nail market is weak, and large offerings are made at $2.75; small lots sell at $2.80@2.85. Wrought iron pipes sell at 70 and 10@75 off list. The trade in stamped tin ware is fair and prices steady; steel continues to decline; demand is very dull and prices for the lower grades are demoralized. The orders for steel rails are all small, and though the quotation of $40 is continued in this market, this figure is being discounted to secure orders. There are large requirements for steel rails, but no immediate prospect of their being placed. Pig iron is in improving demand. There is a good movement, and numerous inquiries; Lake Superior irons are scarce and high; Southern irons continue in favor, and are moving briskly. The hardware trade is active, for shelf and builders' goods, and will probably keep up until the close of the year. Prices are without change, and are well sustained.

PITTSBURGH.

There is nothing very interesting to report in the Pittsburgh iron trade. The demand for all kinds of iron and steel is dull and prices are lower than they have been known to be for a long time. The local furnaces are well employed and are selling their entire output; the mills on manufactured iron are not working full time, and are selling at almost any price in order to keep going. The demand is withheld, and only very small orders are presented. 1.80 to 1.90 is quoted, but iron sells at less. The nail mills are still working, but a suspension will probably be ordered by the association at their next meeting, which takes place on the 14th. The demand is dull at $2.80 to $2.90, with heavy shadings on large orders. Gas and steam pipe is in active demand, but great complaint is made as to low prices obtained. Steel rails are selling at $37 for late delivery and $37.50 for December. The demand for steel is very unsatisfactory and prices continue very low. Railway track supplies are dull at old quotations. Muck bars have sold as low as $32.50, but good brands command $33 to $33.50, Scrap, nominal, at $21 to $23 for best.

COAL.

The anthracite coal trade continues strong and active; Western, Southern and local demand is increasing, and the full output of three-quarters of a million tons per week is being promptly marketed. There is less talk as to restriction, and it is now believed that full production will be continued until the close of the season. The production for the last week reported was 756,354 tons, and for year to same date, 25,686,508 tons, or an increase of 2,269,474 tons over the production to same date last year. The Reading continues to increase its output week by week, and is making heavy shipments to the West. Vessels have been in short supply for a week or two, and, in consequence, stocks have been accumulating at Port Richmond, where there are now about 110,000 tons awaiting vessels. There is less cutting of prices for inferior coals. The larger of furnace sizes are being broken up to supply the domestic demand, and to prevent any accumulation of stocks. The bituminous trade is rather stronger, owing to the fact that several large contracts have been placed, and several others are in prospect. Production of bituminous coal for the past week, 107,-783 tons, and for the year, 4,088,196 tons.